THE POWER BEHIND POWER.

Operating instructions
CAPT® 040+. De-energized tap-changer

13686352/00 EN



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The product may have been altered since this document was published.
We reserve the right to change the technical data, design and scope of supply.
Generally the information provided and agreements made when processing the individual quotations and orders are binding.
The product is delivered in accordance with MR's technical specifications, which are based on information provided by the customer. The customer has a duty of care to ensure the compatibility of the specified product with the customer's planned scope of application.
The original operating instructions were written in German.

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1 Introduction

This technical document contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

It also includes safety instructions and general information about the product.

This technical file is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

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Internet: www.reinhausen.com
MR Reinhausen customer portal: https://portal.reinhausen.com

Further information on the product and copies of this technical file are available from this address if required.

1.2 Completeness

This technical file is incomplete without the supporting documents.

The following documents are considered supporting documents:
- Declaration of Conformity
- Packing list
- Routine test report
- Dimensional drawings
- Order confirmation

1.3 Safekeeping

Keep this technical file and all supporting documents ready at hand and accessible for future use at all times.

1.4 Notation conventions

1.4.1 Hazard communication system

Warnings in this technical file are displayed as follows.

1.4.1.1 Warning relating to section

Warnings relating to sections refer to entire chapters or sections, sub-sections or several paragraphs within this technical file. Warnings relating to sections use the following format:

⚠ WARNING



Type of danger!

Source of the danger and outcome.

› Action

› Action

1.4.1.2 Embedded warning information

Embedded warnings refer to a particular part within a section. These warnings apply to smaller units of information than the warnings relating to sections. Embedded warnings use the following format:

⚠ DANGER! Instruction for avoiding a dangerous situation.

1.4.1.3 Signal words and pictograms

The following signal words are used:

Signal word	Definition
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates measures to be taken to prevent damage to property.

Table 1: Signal words in warning notices

Pictograms warn of dangers:

Pictogram	Definition
	Warning of a danger point
	Warning of dangerous electrical voltage
	Warning of combustible substances

Pictogram	Definition
	Warning of danger of tipping
	Warning of danger of crushing

Table 2: Pictograms used in warning notices

1.4.2 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file it is laid out as follows:

Important information.

1.4.3 Instruction system

This technical file contains single-step and multi-step instructions.

Single-step instructions

Instructions which consist of only a single process step are structured as follows:

Aim of action
✓ Requirements (optional).
› Step 1 of 1.
  » Result of step (optional).
» Result of action (optional).

Multi-step instructions

Instructions which consist of several process steps are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1.
   » Result of step (optional).
2. Step 2.
   » Result of step (optional).
» Result of action (optional).

2 Safety

- Read this technical file through to familiarize yourself with the product.
- This technical file is a part of the product.
- Read and observe the safety instructions provided in this chapter.
- Read and observe the warnings in this technical file in order to avoid function-related dangers.
- The product is manufactured on the basis of state-of-the-art technology. Nevertheless, risks to life and limb for the user or impairment of the product and other material assets due to the function may arise in the event of improper use.

2.1 Appropriate use

The product is a de-energized tap-changer and is used for setting the voltage of oil-immersed transformers. The product is designed solely for use in electrical energy systems and facilities in accordance with IEC 61936-1. If used as intended and in compliance with the requirements and conditions specified in this technical file as well as the warning notices in this technical file and attached to the product, then the product does not present any danger to people, property or the environment. This applies throughout the service life of the product, from delivery, installation and operation to removal and disposal.

The following applies as intended use:

- Use the product only with the transformer specified in the order.
- The serial numbers of the de-energized tap-changer and de-energized tap-changer accessories (drive, drive shaft, bevel gear, protective relay etc.) must match if de-energized tap-changer and de-energized tap-changer accessories are supplied as a set for one order.
- You will find the standard valid for the product and the year of issue on the nameplate.
- Operate the product in accordance with this technical document, the agreed-upon delivery conditions and the technical data.
- Ensure that any necessary work is only performed by qualified personnel.
- Use the equipment and special tools supplied solely for the intended purpose and in accordance with the specifications of this technical document.

2.2 Fundamental safety instructions

To prevent accidents, disruptions and damage as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

Personal protective equipment

Loosely worn or unsuitable clothing increases the danger of becoming trapped or caught up in rotating parts and the danger of getting caught on protruding parts. This poses a danger to life and limb.

- Wear appropriate personal protective equipment such as a helmet, work gloves, etc. for the respective activity.
- Never wear damaged personal protective equipment.
- Never wear rings, necklaces, or other jewelry.
- If you have long hair, wear a hairnet.

Work area

Untidy and poorly lit work areas can lead to accidents.

- Keep the work area clean and tidy.
- Make sure that the work area is well lit.
- Observe the applicable laws for accident prevention in the relevant country.

Working during operation

The product may only be operated in a sound, operational condition. Otherwise it poses a danger to life and limb.

- Regularly check the operational reliability of safety equipment.
- Comply with the inspection work, maintenance work and maintenance intervals described in this technical file.

Explosion protection

Highly flammable or explosive gases, vapors and dusts can cause serious explosions and fire. This increases the danger to life and limb.

- Do not install, operate or perform maintenance work on the product in areas where a risk of explosion is present.

Safety markings

Warning signs and safety information plates are safety markings on the product. They are an important aspect of the safety concept.

- Observe all safety markings on the product.
- Make sure all safety markings on the product remain intact and legible.
- Replace safety markings that are damaged or missing.

Ambient conditions

To ensure reliable and safe operation, the product must only be operated under the ambient conditions specified in the technical data.

- Observe the specified operating conditions and requirements for the installation location.

Auxiliary materials and operating materials

Auxiliary materials and operating materials not approved by the manufacturer can lead to personal injury, damage to property and malfunctions of the product.

- Only use insulating fluids approved by the manufacturer.
- Only use conductive and grounded hoses, pipes and pump equipment that are approved for flammable liquids.
- Only use lubricants and auxiliary materials approved by the manufacturer.
- Contact the manufacturer.

Modifications and conversions

Unauthorized or inappropriate changes to the product may lead to personal injury, material damage and/or operational faults.

- Only modify the product after consultation with Reinhausen GmbH.

Spare parts

Spare parts not approved by Reinhausen GmbH may lead to physical injury, damage to the product and malfunctions.

- Only use spare parts that have been approved by Reinhausen GmbH.
- Contact Reinhausen GmbH.

2.3 Personnel qualification

The person responsible for assembly, commissioning, operation, maintenance and inspection must ensure that the personnel are sufficiently qualified.

Electrically skilled person

The electrically skilled person has a technical qualification and therefore has the required knowledge and experience, and is also conversant with the applicable standards and regulations. The electrically skilled person is also proficient in the following:

- Can identify potential dangers independently and is able to avoid them.
- Is able to perform work on electrical systems.
- Is specially trained for the working environment in which (s)he works.
- Must satisfy the requirements of the applicable statutory regulations for accident prevention.

Electrically trained persons

An electrically trained person receives instruction and guidance from an electrically skilled person in relation to the tasks undertaken and the potential dangers in the event of inappropriate handling as well as the protective devices and safety measures. The electrically trained person works exclusively under the guidance and supervision of an electrically skilled person.

Operator

The operator uses and operates the product in line with this technical file. The operating company provides the operator with instruction and training on the specific tasks and the associated potential dangers arising from improper handling.

Technical Service

We strongly recommend having maintenance, repairs and retrofitting carried out by our Technical Service department. This ensures that all work is performed correctly. If maintenance is not carried out by our Technical Service department, please ensure that the personnel who carry out the maintenance are trained and authorized by Reinhausen GmbH to carry out the work.

Authorized personnel

Authorized personnel are trained by Reinhausen GmbH to carry out special maintenance.

2.4 Personal protective equipment

Personal protective equipment must be worn during work to minimize risks to health.

- Always wear the personal protective equipment required for the job at hand.
- Never wear damaged personal protective equipment.
- Observe information about personal protective equipment provided in the work area.

Protective clothing	Close-fitting work clothing with a low tearing strength, with tight sleeves and with no protruding parts. It mainly serves to protect the wearer against being caught by moving machine parts.
Safety shoes	To protect against falling heavy objects and slipping on slippery surfaces.
Safety glasses	To protect the eyes from flying parts and splashing liquids.
Visor	To protect the face from flying parts and splashing liquids or other dangerous substances.
Hard hat	To protect against falling and flying parts and materials.
Hearing protection	To protect against hearing damage.
Protective gloves	To protect against mechanical, thermal, and electrical hazards.

Table 3: Personal protective equipment

3 Product description

3.1 De-energized tap-changer

3.1.1 Function description

De-energized tap-changers are used for setting the voltage of oil-immersed transformers. In contrast to on-load tap-changers, the required winding taps must be set with the transformer switched off on the high-voltage and low-voltage side.

The de-energized tap-changer is changed over from one operating position to the next by rotating a drive shaft. The de-energized tap-changer is actuated using a motor-drive unit or manual drive.

3.1.2 Design

Depending on the design of the contacts, maximum rated through-currents of 1000 A and 1600 A are possible.

All available versions can be found in the technical data.

The design of the de-energized tap-changer and the designation of its main parts are shown in the supplied drawing.

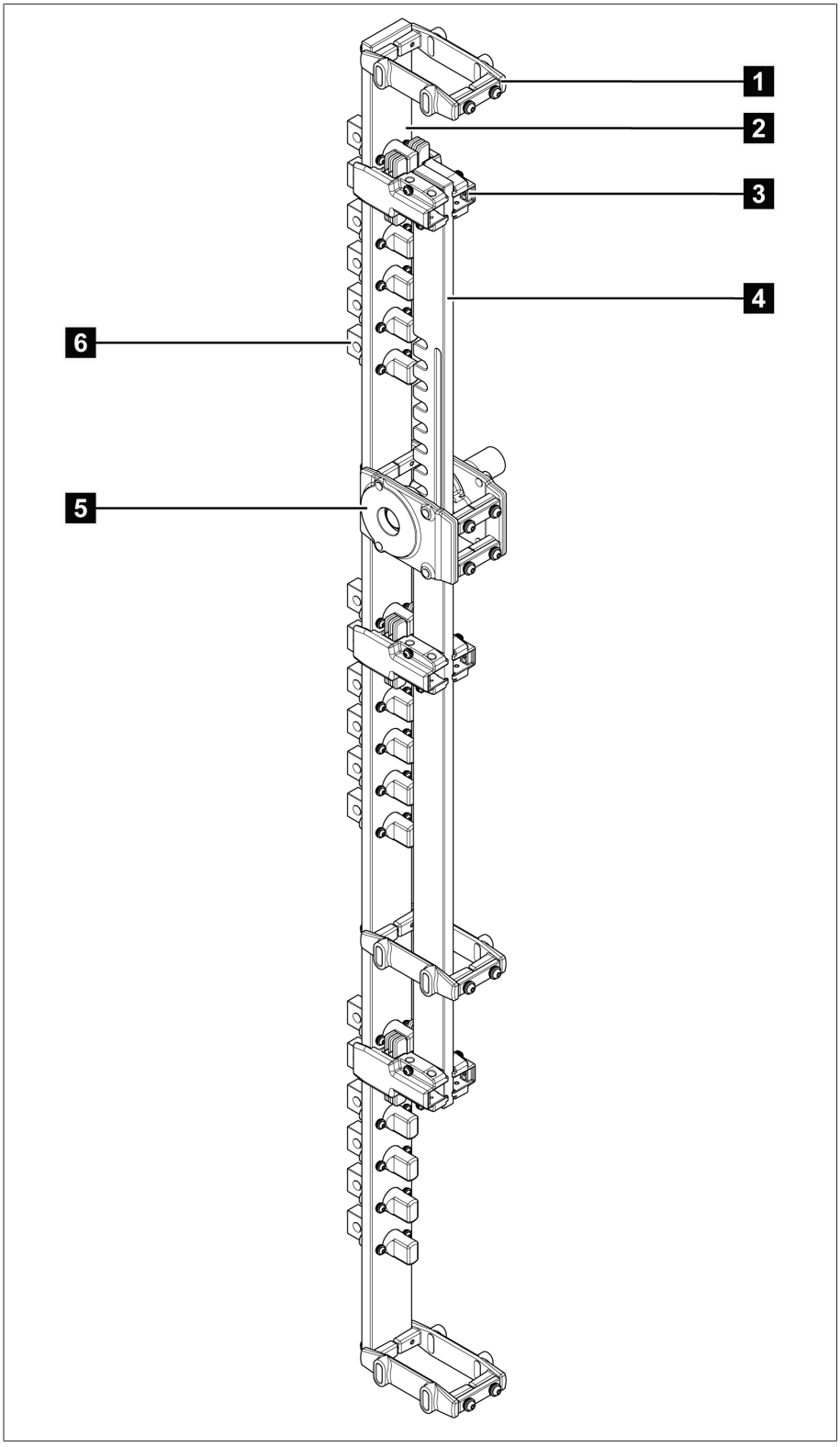


Figure 1: CAPT®040+, bridge connection

1	Support bracket	2	Fixed bar
3	Moving contacts	4	Moving bar
5	Gear unit	6	Fixed contacts

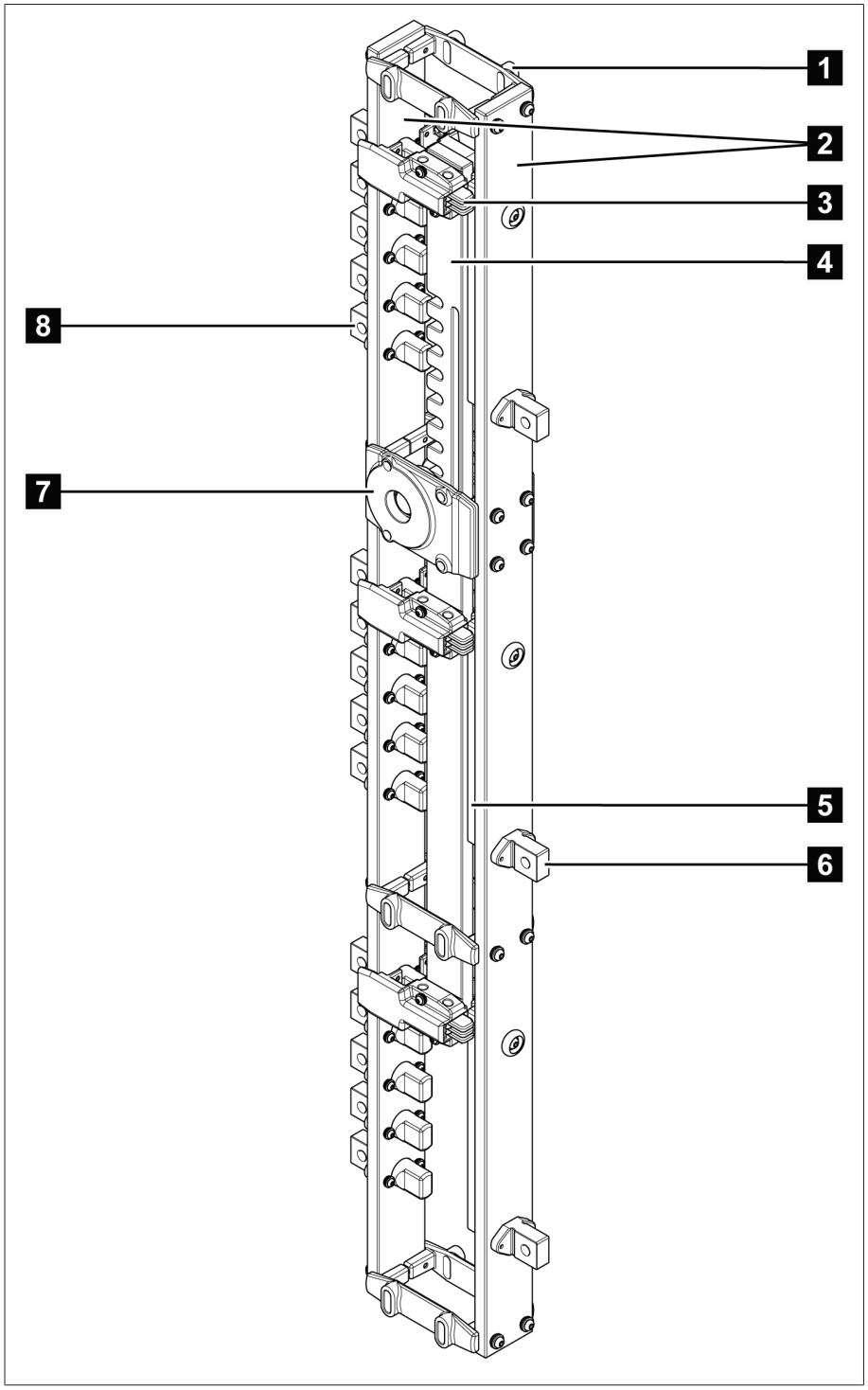


Figure 2: CAPT®040+, linear connection

1	Support bracket	2	Fixed bar
3	Moving contacts	4	Moving bar
5	Common fixed bar	6	Common fixed contacts
7	Gear unit	8	Fixed contacts

3.2 Scope of delivery

If required, the product is packaged with protection against moisture and is delivered as follows:
- De-energized tap-changer with/without protective shields (depending on order)
- Manual drive or motor-drive unit (depending on the order)
- Drive shaft with coupling parts and bevel gear (depending on order)
- Technical files
- Nameplate

Note the following information:
- Check the shipment against the shipping documents for completeness
- Store the parts in a dry place until installation
- The product must remain in its airtight, protective wrapping (if present) and may only be removed immediately before installation

You will find more information in the "Packaging, transport, and storage" [▶Section 4, Page 16] chapter.

3.3 Drive shafts and bevel gears

Internal drive shafts

The internal drive shafts are the mechanical connection between the individual de-energized tap-changer columns and between the outer bevel gear/drive and the neighboring de-energized tap-changer column.

The maximum permissible axial offset of the internal drive shaft is 8° without cardan joint and 45° with cardan joint.

As an option, a conical plug-in coupling between the bevel gear/drive and the neighboring de-energized tap-changer column is available that facilitates the connection between the inner drive shaft and the outer bevel gear/drive shaft. It also allows an axial offset of 8° between the shafts on both sides as well as disassembly of the bevel gear/drive without uncoupling the internal drive shaft.

External drive shafts

The external drive shafts are the mechanical connection between the bevel gears and between the bevel gear and drive.

The maximum permissible axial offset of the drive shaft is 45° with cardan joint.

The drive shafts consist of a square tube. They are coupled at each end by two coupling brackets and one coupling element to the driving or driven shaft end of the device to be connected.

The square tubes are supplied in overlengths and must be cut to the required size before mounting on the transformer.

Protective covers are available as an option when using the manual drive.

Bevel gear

The change of direction from the vertical to the horizontal direction is achieved by means of a bevel gear mounted on the outside of the transformer. Depending on the arrangement of the de-energized tap-changer columns in the transformer and the position of the drive, one or more bevel gears may be necessary.

4 Packaging, transport and storage

4.1 Suitability and structure

NOTICE

Property damage due to incorrectly stacked crates!

Stacking the crates incorrectly can lead to damage to the packaged goods.

- Stack a maximum of 2 equally sized wooden crates on top of one another.
- Do not stack wooden crates above a height of 1.5 m.
- Do not stack cardboard boxes on top of one another.

The goods are packaged in a stable cardboard box or a wooden crate. This ensures that, when in the intended transportation position, the packaged goods are stabilized to prevent impermissible changes in position, and that none of their parts touch the loading surface of the means of transport or touch the ground after unloading.

If required, a sealed packaging surrounds the packaged goods with plastic foil on all sides. The packaged goods are protected from humidity using a desiccant. The plastic foil was bonded after the desiccant is added.

4.2 Markings

The packaging bears a signature with instructions for safe transport and correct storage. The following symbols apply to the shipment of non-hazardous goods. Adherence to these symbols is mandatory.

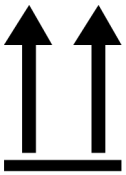
		
Protect against moisture	Top	Fragile

Table 4: Shipping pictograms

4.3 Transportation, receipt and handling of shipments

⚠ WARNING



Danger of death or severe injury!

Danger of death or severe injury due to tipping or falling load.

- Only transport the crate/cardboard box when closed.
- Do not remove the securing material used in the crate during transport.
- Only trained and authorized persons may select the sling gear and secure the load.
- Do not walk under the suspended load.
- Use means of transport and lifting gear with a sufficient carrying capacity in accordance with the weight stated on the delivery slip.

In addition to oscillation stress, jolts must also be expected during transportation. In order to prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

If a crate tips over, falls from a certain height (e.g. when slings tear) or experiences an unbroken fall, damage must be expected regardless of the weight.

Every delivered shipment must be checked for the following by the recipient before acceptance (acknowledgment of receipt):

- Completeness based on the delivery slip
- External damage of any type

The checks must take place after unloading when the crate or transport container can be accessed from all sides.

Visible damage

If externally visible transport damage is detected upon receipt of the shipment, proceed as follows:

- Immediately record the identified transport damage in the shipping documents and have this countersigned by the carrier.
- In the event of severe damage, total loss or high damage costs, immediately notify the manufacturer and the relevant insurance company.
- After identifying damage, do not modify the condition of the shipment further and retain the packaging material until an inspection decision has been made by the transport company or the insurance company.
- Record the details of the damage on-site immediately with the transport company involved. This is essential for any claim for damages!
- Photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture (rain, snow, condensation) infiltrating the packaging.
- *NOTICE!* Damage to packaged goods due to damaged sealed packaging. If the product is delivered in sealed packaging, check the sealed packaging immediately. If the sealed packaging is damaged, do not under any circumstances install or commission the packaged goods.
- Identify the damaged parts.

Hidden damage

When damages are not determined until unpacking after receipt of the shipment (hidden damage), proceed as follows:

- Make the party responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
- Observe the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damages can only be successful if relevant provisions are expressly included in the insurance terms and conditions.

4.4 Storage of shipments

When selecting and setting up the storage location, ensure the following:
- Never store goods outdoors.
- Protect stored goods against moisture (flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites and so on, and against unauthorized access.
- Store the crates on timber beams and planks as a protection against rising damp and for better ventilation.
- Ensure sufficient load-bearing capacity of the ground.
- Keep entrance paths clear.
- Check the stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow etc.

Protect the packaging foil from direct sunlight so that it does not disintegrate under the influence of UV rays, which would cause the packaging to lose its sealing function.

If the product is installed more than 6 months after delivery, suitable measures must be taken without delay. The following measures can be used:
- Correctly regenerate the drying agent and restore the sealed packaging.
- Unpack the packed goods and store in a suitable storage space (well-ventilated, as dust-free as possible, humidity < 50% where possible).

4.5 Unpacking shipments and checking for transportation damages

- *NOTICE!* Damage to packaged goods due to ineffectively sealed packaging. Transport the packaged crate to the place where the packaged goods are to be installed. Do not open the sealed packaging (if present) until just before installation.
- ⚠ WARNING! Serious injuries and damage to the packaged goods due to the packaged goods tipping out. Place the packaged goods in an upright crate and protect them from tipping out.
- Unpack the packaged goods and check the condition.
- Check the completeness of the accessories kit based on the delivery slip.

5 Installation

⚠ WARNING



Risk of crushing!

During a tap-change operation, components of the de-energized tap-changer move, some of which are freely accessible. Reaching into the de-energized tap-changer during a tap-change operation may result in serious injuries.

- Keep at a safe distance of at least 1 m during tap-change operations.
- Do not reach into the de-energized tap-changer during tap-change operations.
- Do not switch the de-energized tap-changer when working on the de-energized tap-changer.

5.1 Installing the de-energized tap-changer in the transformer

Installation configurations

The de-energized tap-changer can be installed in the transformer in various configurations.

The single-column version of the de-energized tap-changer with one or multiple decks can be installed horizontally on the core of the transformer.

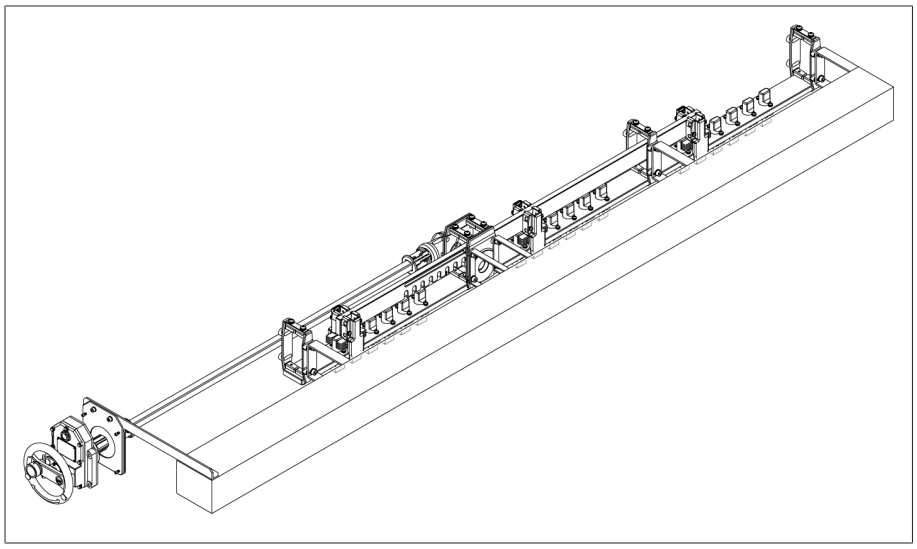


Figure 3: Single-column configuration, transformer core

The single-column version of the de-energized tap-changer with one or multiple decks can be installed horizontally on the transformer cover.

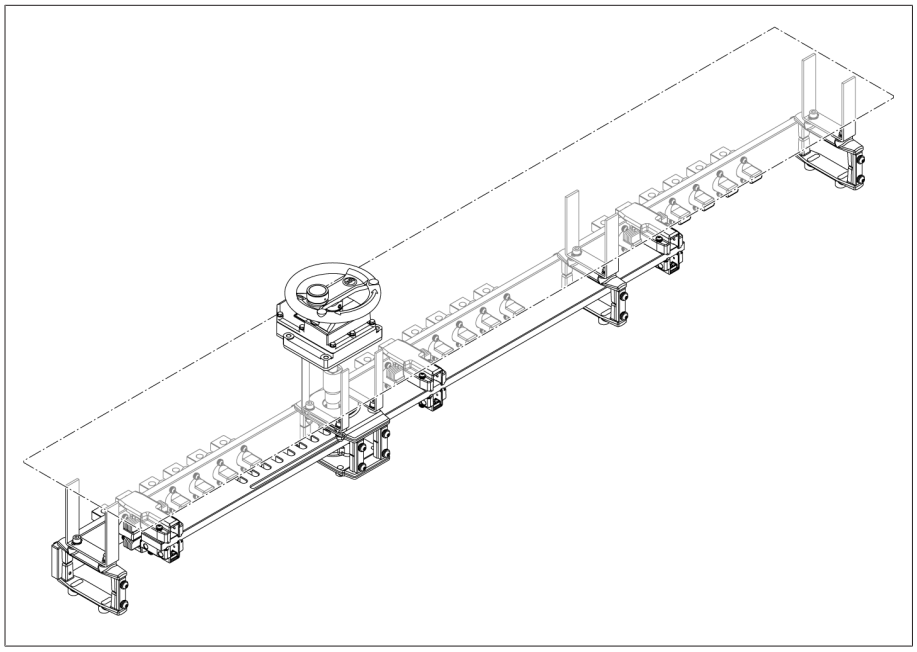


Figure 4: Single-column configuration, transformer cover

The de-energized tap-changer can be installed with a single column or multiple columns with one or more decks vertically on the core of the transformer.

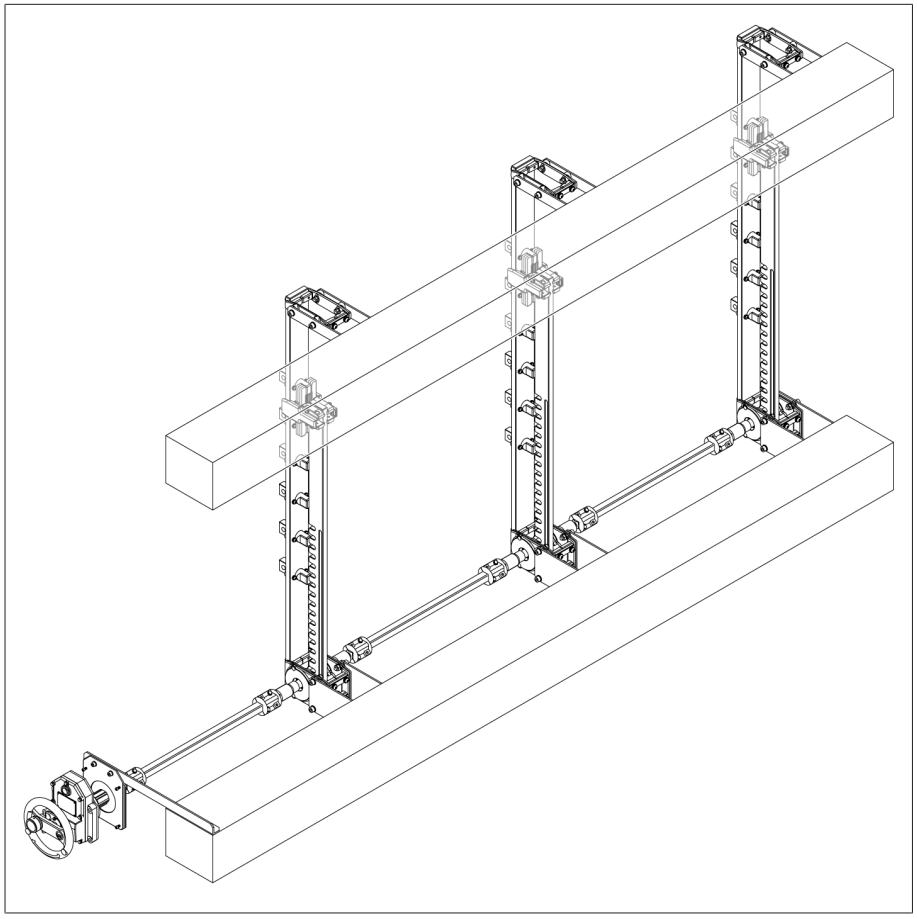


Figure 5: Three-column configuration

Fitting holding devices in the transformer

Prior to installing the de-energized tap-changer columns in the transformer, you must fit holding devices in the transformer to which the column or columns will be fastened. Each column will be fastened to the holding device via both the gear unit and the support bracket.

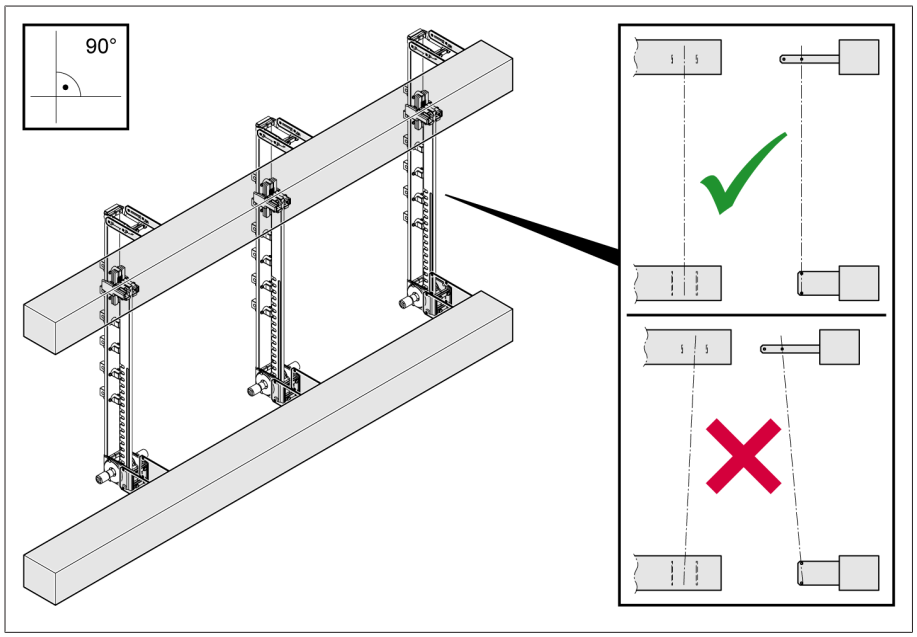


Figure 6: Holding devices

The holding devices for the gear unit must be made of metal and may not protrude beyond the gear unit in the direction of the main switching contacts to ensure a sufficiently large insulation distance.

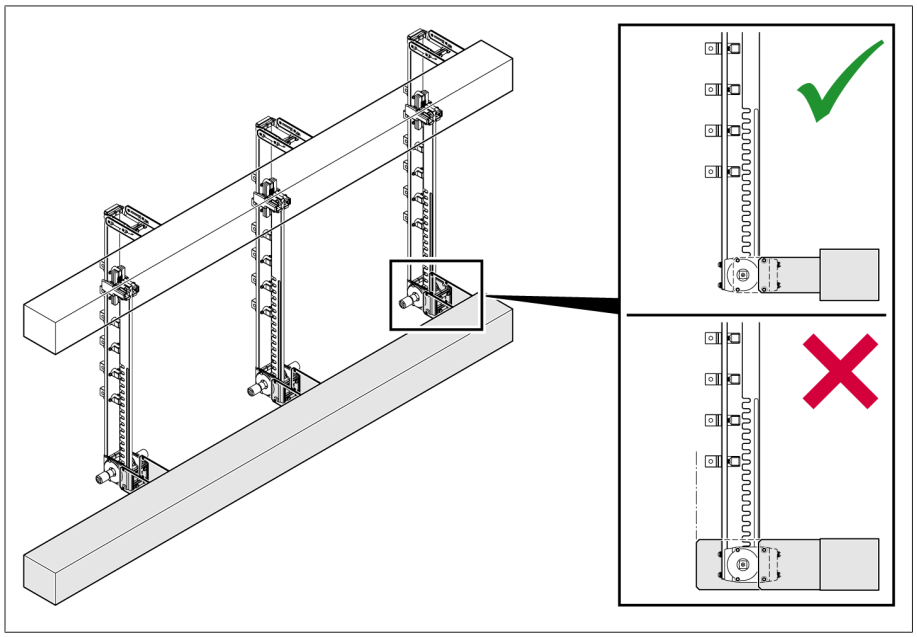


Figure 7: Holding device on the gear unit

The holding devices for the supporting bars can be made of metal or an insulating material. Metal holding devices must not have any sharp edges and must have rounded corners to prevent dangerous electrical fields. With metal holding devices, also observe the maximum permissible length in the direction of the

main switching contacts to ensure a sufficiently large insulation distance. If the supporting bar is made of an insulating material, you must ground the support brackets.

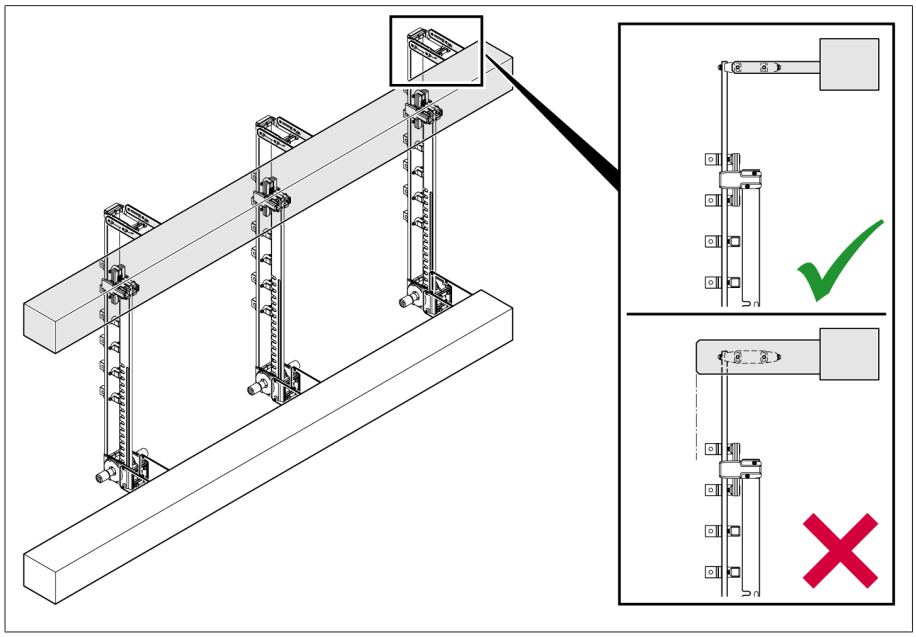


Figure 8: Holding device on the supporting bar

Fastening the de-energized tap-changer to the holding devices

Installation may only proceed if the gear unit is located between the stages of the de-energized tap-changer. If the gear unit is not positioned between the stages of the de-energized tap-changer, change the position of the gear unit by moving the movable bar to avoid damage to the product.

In the version with multiple de-energized tap-changer columns or multiple contact planes, the de-energized tap-changer columns and contact planes are numbered from 1 to n. Refer to the information on the name plate attached to the gear unit regarding this. Here, column 1 is always the column that must be fastened next to the transformer outlet. The fastening material is not included in the scope of delivery.

1. ⚠ CAUTION! An unstably positioned column may tip, resulting in injuries or property damage. Place the de-energized tap-changer column on a level surface and secure it against tipping.
2. *NOTICE!* Damage to the de-energized tap-changer column due to incorrect lifting. Lift the de-energized tap-changer column using the gear unit or the two supporting bars and carefully move it into the correct position. When doing so, ensure that the main switching contacts and shielding rings are not damaged.
3. *NOTICE!* Damage to the de-energized tap-changer column due to unsecured support brackets. Make sure that all support brackets are secured before the de-energized tap-changer is moved.

4. Fasten the gear unit with at least 2 screws.

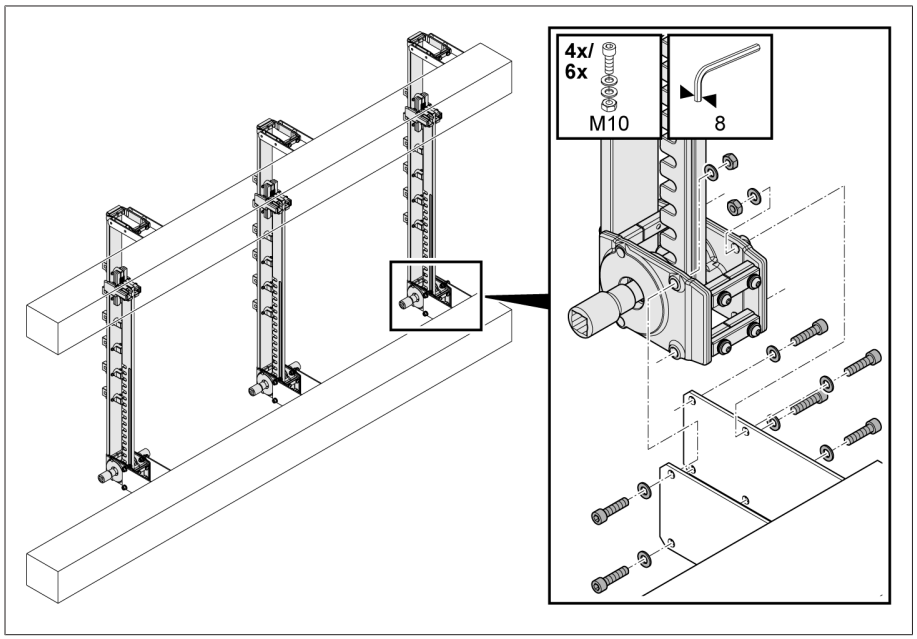


Figure 9: Fastening the gear unit

5. Fasten the de-energized tap-changer support brackets to the holding devices. Only tighten the screws slightly so that the column still has room to move, because the material shrinks as it dries.

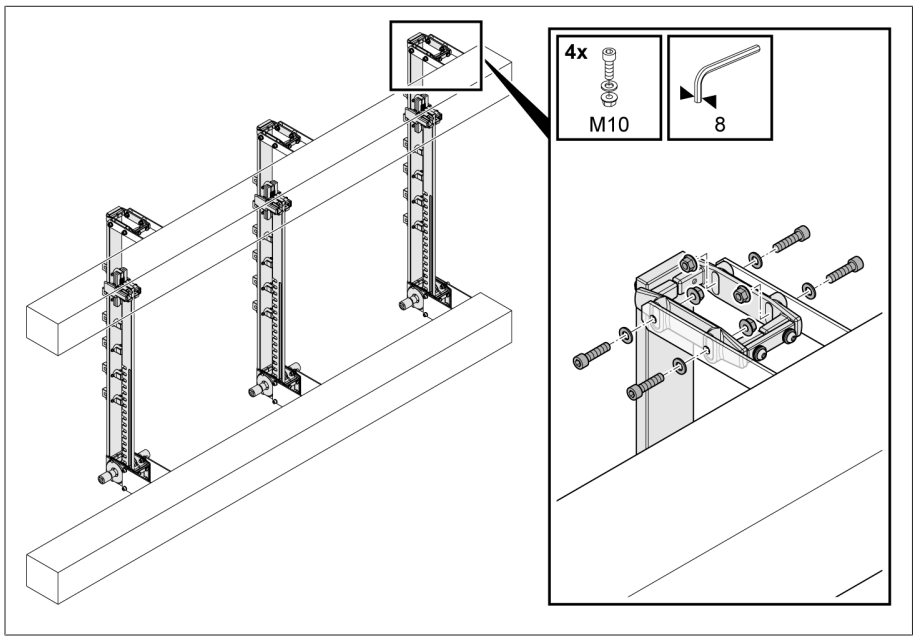


Figure 10: Fastening the supporting bar

5.2 Connecting the de-energized tap-changer to the tap winding

NOTICE

Damage to the de-energized tap-changer from improperly connecting the de-energized tap-changer to the tap winding!

Incorrectly installed leads can exert mechanical tension on the connection contacts, resulting in changes in the position of the connection contacts and impairment of correct contacting.

- Install and secure the lines so that the application of force to the de-energized tap-changer is kept to a minimum during drying and under all operating, testing and malfunction conditions (e.g. short circuit).
- Route the lines with a sufficient clearance to metal parts on the de-energized tap-changer to avoid electrical flashovers.
- Lay out the ends of the connections as expansion loops.
- Comply with the specified tightening torques.
- Do not remove the potential equalization connections (if present) between the shielding rings and contacts.

There are 2 versions of the fixed contacts. These can either be threaded contacts or flat contacts.

1. Affix the threaded fixed contacts of the tap-winding connection leads to the de-energized tap-changer using cable shoes (not included in the scope of delivery) in accordance with the provided connection diagram. Bridges for the parallel connection of connection contacts are not included in the scope of delivery.
2. Take suitable measures to secure each threaded connection against loosening and settling.

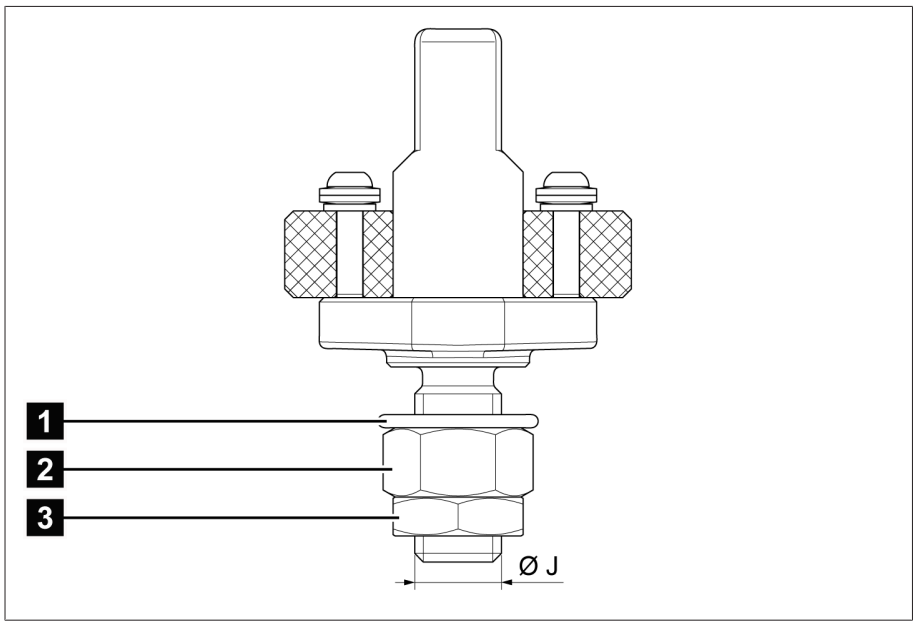


Figure 11: Threaded connection contact

1	Washer	2	Nut A
3	Nut B		

	Nut A tightening torque	Nut B tightening torque
M20	80 Nm	80 Nm
M24	120 Nm	120 Nm

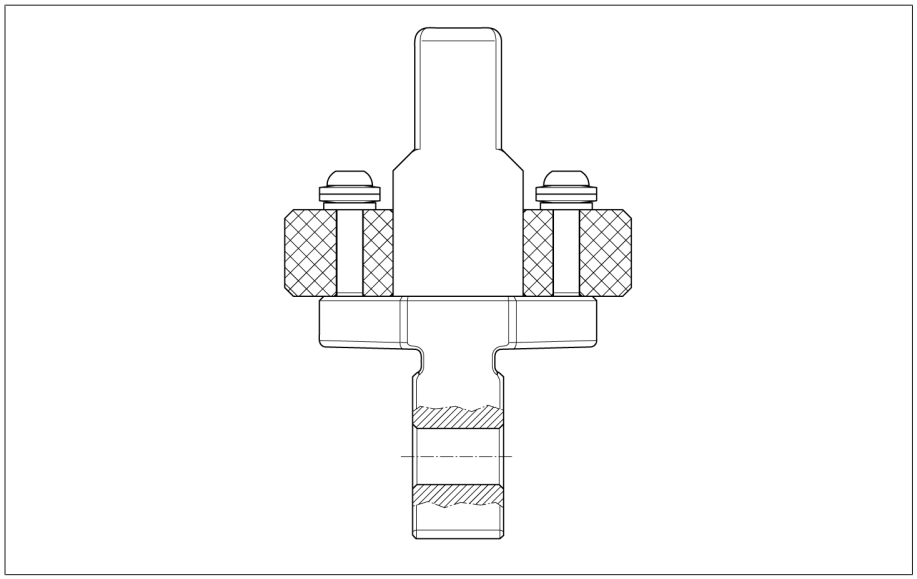


Figure 12: Flat connection contact

5.3 Aligning the contact system

In the delivered state, all of the de-energized tap-changer columns are in the same operating position. The operating position is indicated in the order confirmation. The corresponding drive is in the same position in the delivered state. Under certain circumstances, the moving contacts may become displaced when the de-energized tap-changer columns are connected to the tap winding, meaning that you must check the position of the moving contacts and correct the position if necessary.

Depending on the version of the de-energized tap-changer, the moving contacts must either be exactly centered between 2 fixed contacts or exactly on the fixed contact.

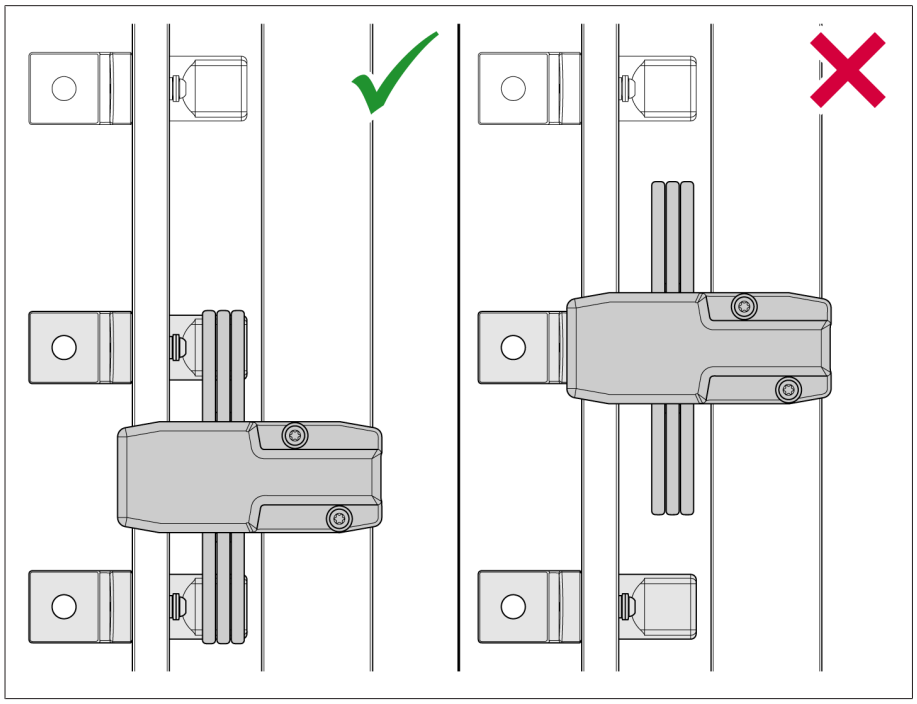


Figure 13: Moving contacts between 2 fixed contacts

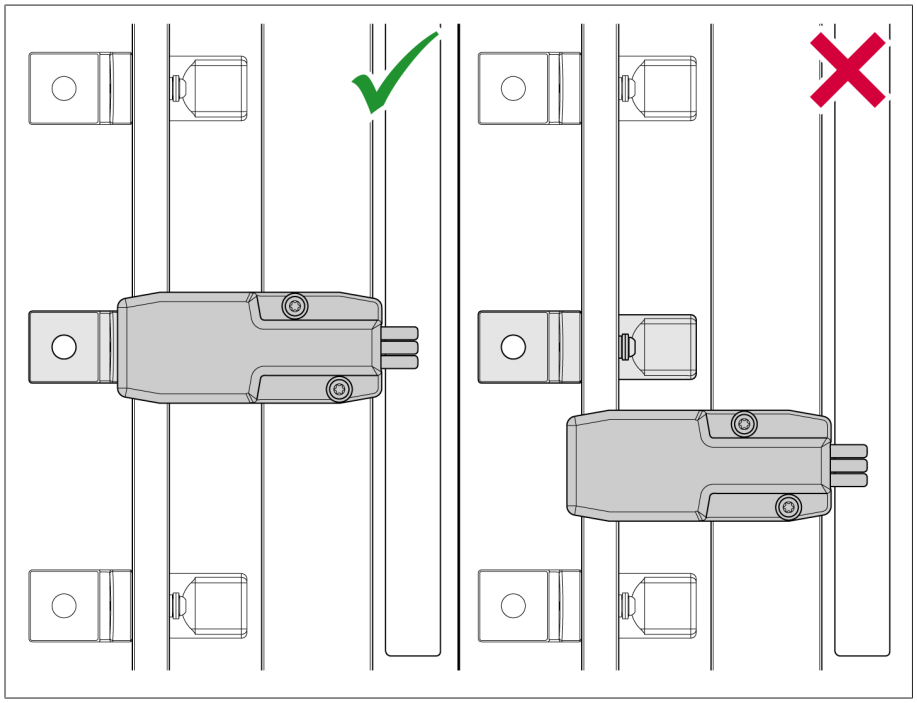


Figure 14: Moving contacts on a fixed contact

To align the moving contacts, proceed as follows:

1. ⚠ WARNING! An energized transformer could cause death or serious injuries when aligning the contacts! Ensure that the transformer is switched off on the high- and low-voltage sides before aligning the contact system.
2. *NOTICE!* Damage to the de-energized tap-changer. Wet all of the contacts on the de-energized tap-changer columns with mineral insulating oil for transformers before actuating the de-energized tap-changer.
3. Use a square tube (25 mm nominal width) and a spanner wrench to turn the shaft on the gear unit.

4. In the case of versions with multiple columns, also set the moving contacts on all other de-energized tap-changer columns to the mid-position and align them.
5. In the case of versions with multiple columns, make sure that all de-energized tap-changer columns are aligned in the same way before mounting the internal drive shafts.

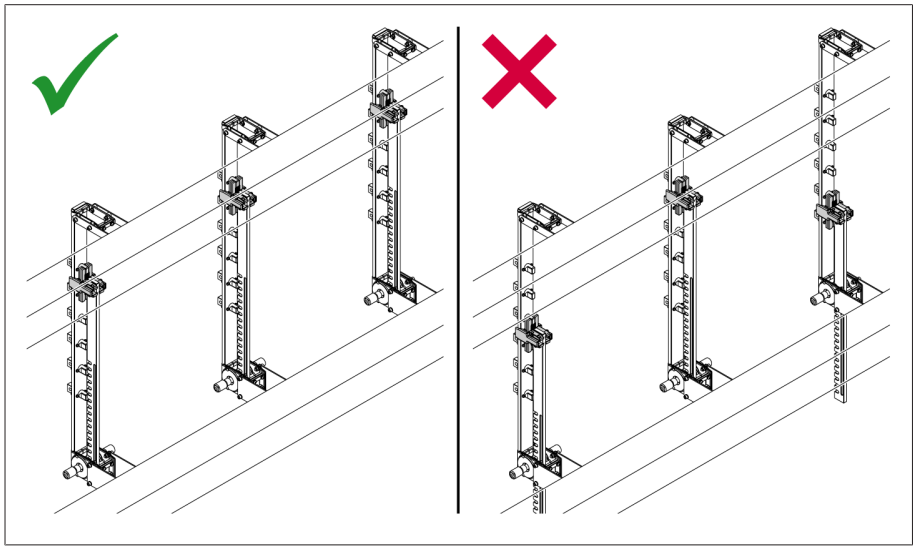


Figure 15: Aligning the de-energized tap-changer columns

5.4 Mounting internal drive shafts

In the case of the version with de-energized tap-changer columns, the mechanical connection between the individual de-energized tap-changer columns and between the outer bevel gear/drive and the neighboring de-energized tap-changer column is made via drive shafts (square tubes) that are delivered not cut to size.

Permitted axial displacement without cardan joints

Minor axial displacements of the drive shafts can be tolerated as long as they do not exceed an angle of max 8°.

Permitted axial displacement with cardan joints

Minor axial displacements of the drive shafts can be tolerated as long as they do not exceed an angle of max 45°.

Mounting internal drive shafts

The following describes how to mount the drive shafts without cardan joints. On versions with cardan joints, the cardan joints are already mounted at the factory and the drive shafts are mounted onto the cardan joints – as described in the following – with coupling brackets, but without the bolts.

1. *NOTICE!* Damage to de-energized tap-changer and transformer due to incorrectly aligned gear unit shafts. Ensure that the moving contacts of all de-energized tap-changer columns are correctly aligned and, in the case of the version with multiple de-energized tap-changer columns, all de-energized tap-changer columns are in the same position.
2. Fasten the conical plug-in coupling (if available) on the transformer in accordance with the drawing.

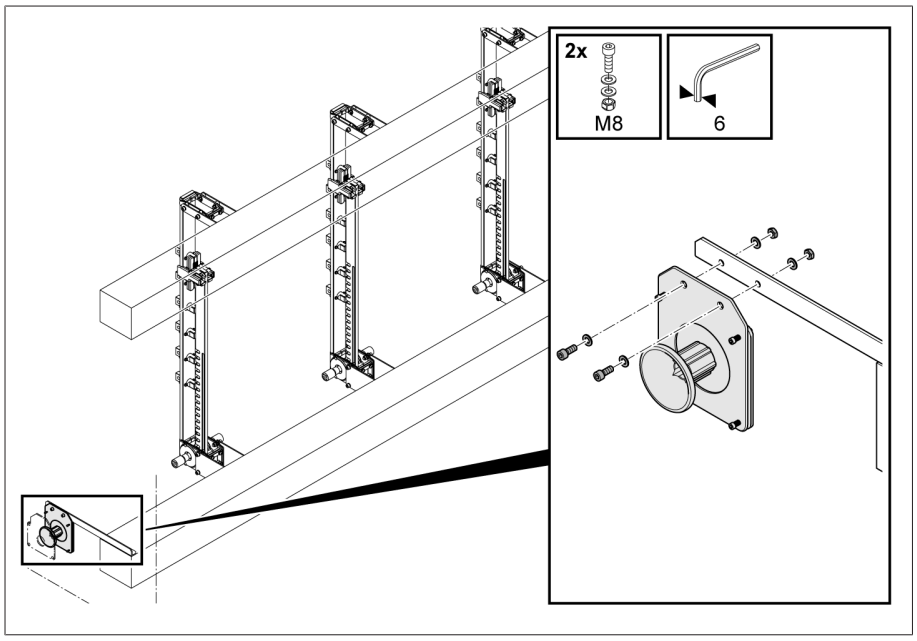


Figure 16: Conical plug-in coupling

3. Shorten the square tubes in accordance with the drawings [▶Section 11.1, Page 45]. If the clearance between 2 de-energized tap-changer columns or between the bevel gear/drive and the adjacent de-energized tap-changer column is between 2 m and 3 m, you must use 2 drive shafts for the connection. If the clearance is between 3 m and 4 m, 2 drive shafts and an intermediate bearing must be used.
4. Insert the bolt into the square hole in the drive shaft of the gear unit.

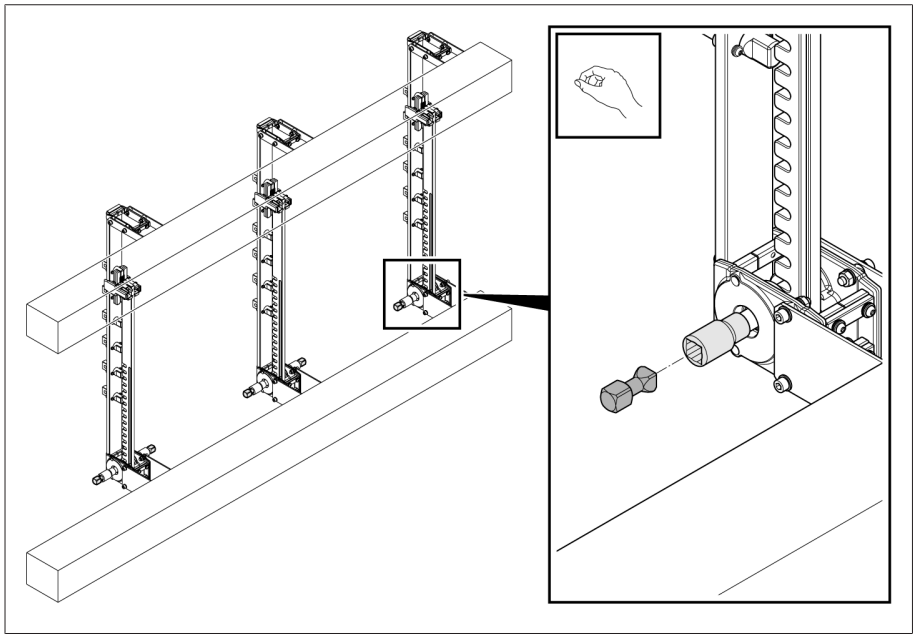


Figure 17: Pin

5. Ensure that all the above steps have been carried out correctly, as loosening the coupling brackets has a detrimental effect on the thread locker applied ex works.
6. Connect the bolt and square tube with coupling brackets. The square tube must be positioned in the coupling brackets up to the stop. The brass bolt must be so far into the coupling brackets that the flat sides of the brass bolt are completely covered by the coupling brackets. The axial clearance should be a maximum of 10 mm.

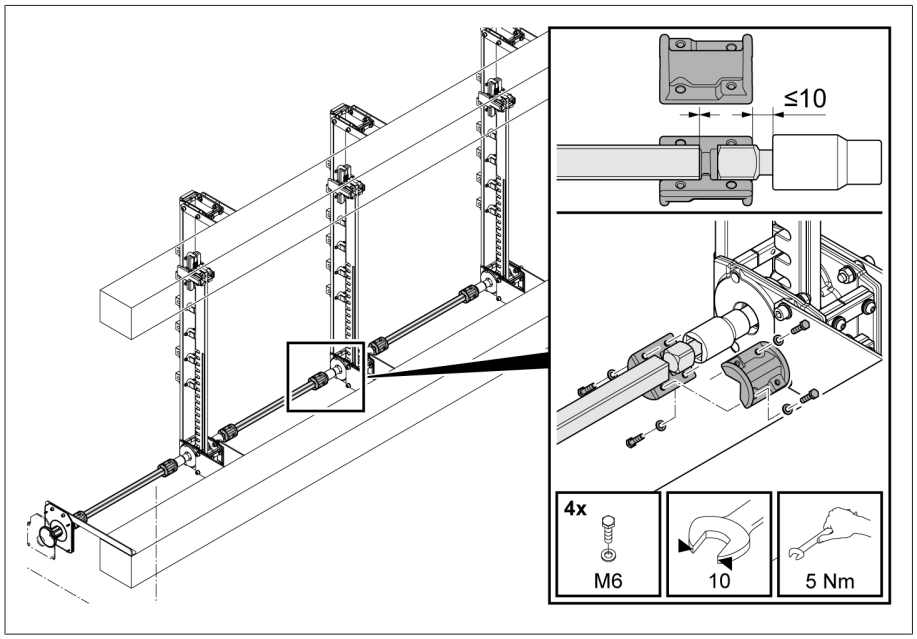


Figure 18: Coupling brackets

5.5 Mounting protective shields

Mount the protective shields (if present) on the de-energized tap-changer in accordance with the drawings [▶Section 11.2, Page 52].

5.6 Performing the transformer ratio test

Carry out a transformer ratio test before the transformer dries.

1. ⚠ WARNING! An energized transformer could cause death or serious injuries! Ensure that the transformer is disconnected on the high-voltage and low-voltage sides.
2. *NOTICE!* Damage to de-energized tap-changer resulting from switching without oil. Wet all of the de-energized tap-changer contacts with mineral insulating oil for transformers before the transformer ratio test.
3. Now move de-energized tap-changer into the desired operating position.
4. Carry out the transformer ratio test in all operating positions. Check the reached operating position in each case. Never move de-energized tap-changer beyond the limit positions (see supplied connection diagram).
5. Upon completion of the transformer ratio test, switch the de-energized tap-changer to the desired operating position.

5.7 Drying the de-energized tap-changer

NOTICE

Damage to the drive and bevel gears!

The drive and bevel gears will become damaged if they are dried.

› Never dry the drive or bevel gears.

A prerequisite for the dielectric values assured by MR for the de-energized tap-changer is a minimum drying process (vacuum-drying or vapor-phase drying) performed following the instructions below.

Vacuum-drying

1. Pre-dry the de-energized tap-changer in circulating air at a max. temperature of 120 °C for a period of 8 hours.
2. Dry the de-energized tap-changer at a maximum temperature of 120 °C for at least 3 hours, residual pressure of approx. 10^{-3} bar.

Vapor-phase drying

The temperature at the de-energized tap-changer must not exceed 120 °C.

The duration of the drying process is the same as that of the transformer. However, it must be at least 8 hours.

5.8 Performing test tap-change operations

1. *NOTICE!* Damage to de-energized tap-changer resulting from switching without oil. Wet all of the de-energized tap-changer contacts and all gears with mineral insulating oil for transformers.

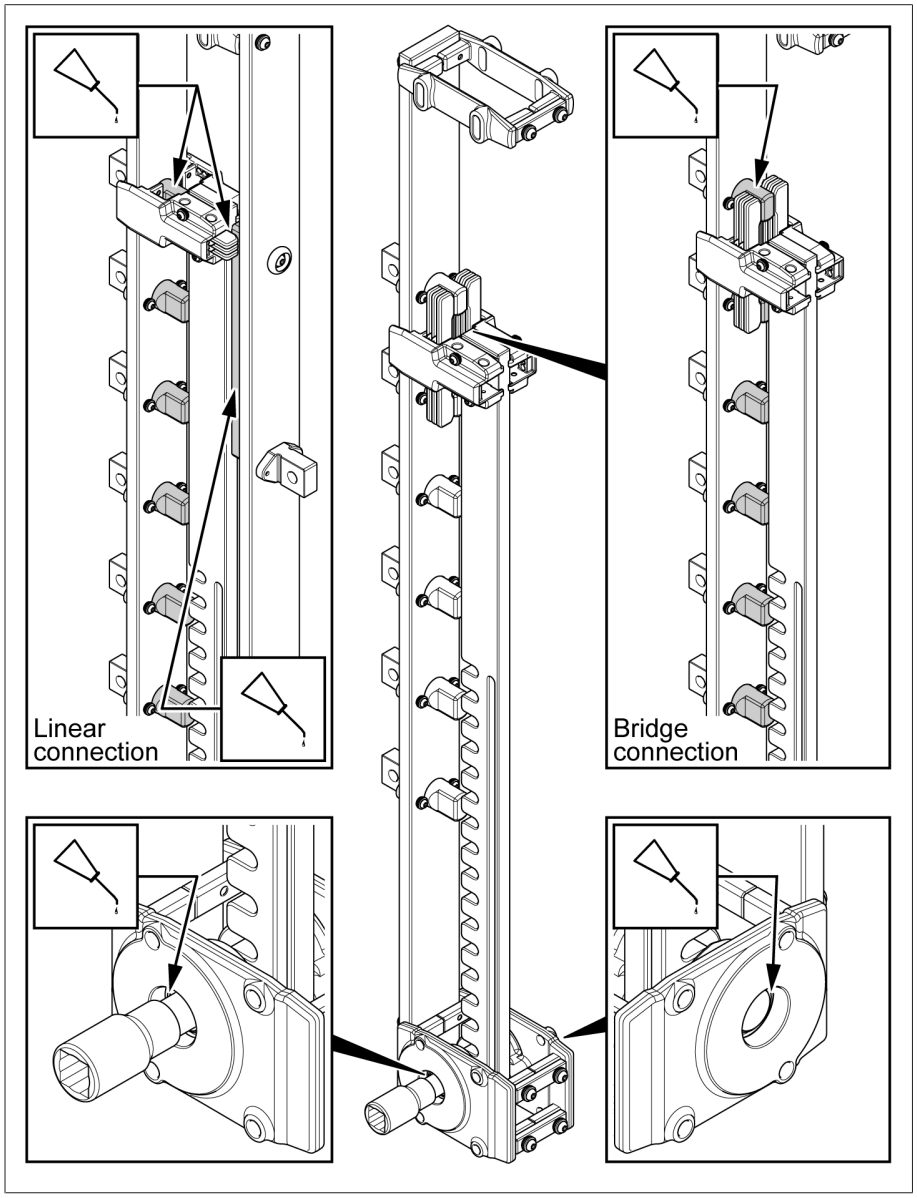


Figure 19: Lubrication points

2. Undertake test tap-change operations across the entire range of settings. It must be possible to reach both limit positions without great effort. In each operating position, check that the moving contacts are correctly aligned and contacted.

» The test tap-change operations are complete.

5.9 Filling the transformer with oil

1. Note the operating position of the de-energized tap-changer for mounting the drive. It is not possible to check the operating position of the de-energized tap-changer after filling the transformer.
2. Fill the transformer with new insulating oil for transformers. Insulating oils for transformers must comply with the relevant standards, especially with respect to dielectric strength and water content (e.g. IEC 60296).

5.10 Fitting the bevel gear and drive

Fitting the bevel gear

Depending on the arrangement of the de-energized tap-changer columns and drive shafts, one or more bevel gears must be fitted on the transformer. The holding devices necessary for this are not included in the scope of delivery. The transformer manufacturer is responsible for the design of the holding devices (type of material, size, shape) and their mounting.

› Fit the bevel gear onto the transformer in accordance with the drawings [▶Section 11.3, Page 54].

Fitting the drive

Depending on the version of the drive, holding devices may be required to mount the drive on the transformer. The holding devices are not included in the scope of delivery. The transformer manufacturer is responsible for the design of the holding devices (type of material, size, shape) and their mounting.

› Mount the drive on the transformer in accordance with the drawings [▶Section 11.3, Page 54].

Affixing the nameplate

The nameplate is included in the scope of delivery.

› Affix the nameplate in a clearly visible position as close to the drive as possible.

5.11 Mounting the external drive shafts

The mechanical connection between the bevel gears and between the bevel gear and drive is made via drive shafts (square tubes) that are delivered not cut to length.

Permitted axial displacement with cardan joints

Minor axial displacements of the drive shafts can be tolerated as long as they do not exceed an angle of max 45°.

Mounting the drive shafts between the bevel gears

1. Shorten the square tubes in accordance with the drawing [▶Section 11.4, Page 57]. If the clearance between 2 bevel gears is between 2 m and 3 m, you must use 2 drive shafts for the connection.
2. Deburr the cut surfaces of the square tubes.
3. Grease the cardan joint on the bevel gears and fasten the rubber sleeve with a hose clip.
4. When using a telescopic protective tube [▶Section 11.5, Page 60]: Push the outer tube (diameter 85 mm) over the inner tube (diameter 80 mm). When doing so, make sure that the non-slotted side of the inner tube is facing up-

wards. Slide the telescopic protective tube onto the square tube. Then slide the hose clips over the telescopic protective tube. With the vertical drive shaft, the outer tube (diameter 85 mm) must be at the top.

5. Attach the square tube to the cardan joints of the bevel gears using coupling brackets.
6. When using a telescopic protective tube: Attach the outer tube and inner tube to the bevel gears using hose clips in accordance with the drawing [▶Section 11.5, Page 60].

Mounting the drive shaft between the bevel gear and drive

1. ⚠ CAUTION! Risk of injury from starting the motor-drive unit by accident. Set the motor-drive unit (if present) to manual operation.
2. Shorten the square tube in accordance with the drawing [▶Section 11.4, Page 57]. If the clearance between the drive and the adjacent bevel gear is between 2 m and 3 m, you must use 2 drive shafts for the connection.
3. Deburr the cut surfaces on the square tube.
4. Switch the drive to the same operating position as the de-energized tap-changer in accordance with the associated instructions. The de-energized tap-changer must be in the mid-position.
5. Insert the coupling element (cardan joint or square bolt) into the drive shaft of the drive. *NOTICE!* Improper mounting of the cardan joint may result in damage or malfunctions. Ensure that the folding cardan joint does not damage the rubber sleeve during mounting. Ensure that the angle of deflection α is no greater than 45°. Ensure that the angle of deflection α is the same on both cardan joints.

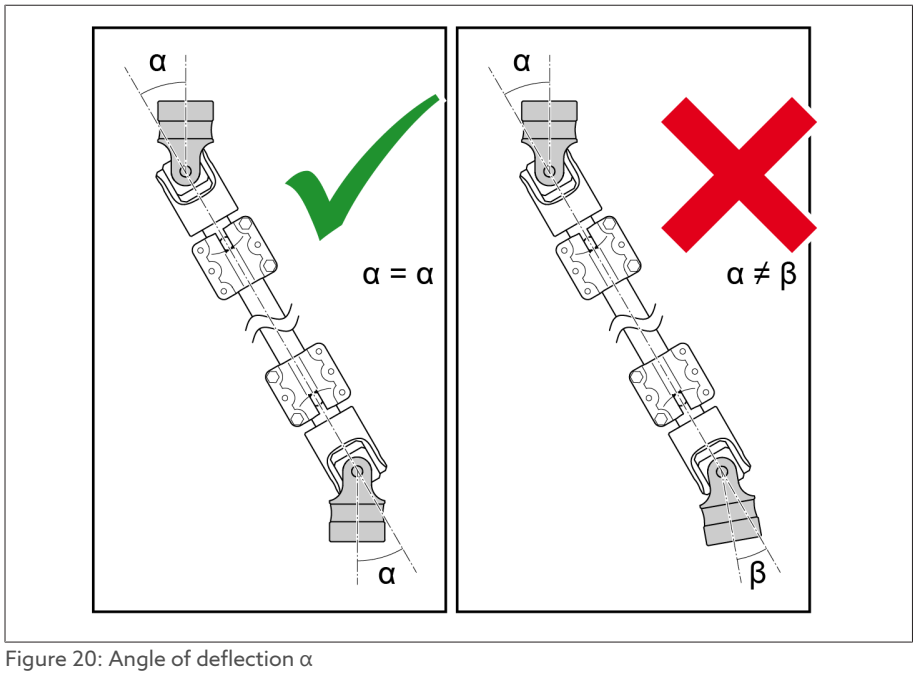


Figure 20: Angle of deflection α

6. Attach the square tube to the drive and bevel gear using coupling brackets.
7. When using a cardan joint: Drill a 6 mm diameter hole in the cardan joint and the drive shaft of the drive and secure the cardan joint with the supplied pin.
8. When using a cardan joint: Remove the coupling brackets, grease the cardan joint and attach the protective collar using a hose clip.
9. When using a telescopic protective tube [▶Section 11.5, Page 60]: Remove the coupling brackets and push the outer tube (diameter 85 mm) over the inner tube (diameter 80 mm). When doing so, make sure that the non-slotted side of the inner tube is facing upwards. Slide the telescopic protective tube onto the square tube. Then slide the hose clips over the telescopic protective

tube. With the vertical drive shaft, the outer tube (diameter 85 mm) must be at the top. When using a telescopic protective tube, no axial displacement is permitted.

10. Attach the square tube to the bevel gear and drive using coupling brackets.
11. When using a telescopic protective tube: Attach the outer tube and inner tube to the bevel gear and drive using hose clips in accordance with the drawing [▶Section 11.5, Page 60].

> **i** Do not uncouple the de-energized tap-changer once it has been successfully connected to the drive. Otherwise all of the setup steps listed in this chapter must be repeated. Removing the coupling brackets requires an increased torque due to the screw coating.

5.12 Making the electrical connections for the drive

Make the electrical connections for the drive as described in respective operating instructions.

6 Commissioning

6.1 Commissioning the de-energized tap-changer at the transformer manufacturer's site

Perform the following work and functional checks before commissioning the transformer.

6.1.1 Grounding the drive

Connect the grounding screw on the drive to the transformer tank.

6.1.2 Function tests

Check the mechanical function of the drive and de-energized tap-changer before energizing the transformer.

1. ⚠ WARNING! An energized transformer could cause death or serious injuries! Ensure that the transformer is disconnected on the high-voltage and low-voltage sides.
2. Lock transformer to prevent unintentional start.
3. *NOTICE!* Damage to the de-energized tap-changer due to actuation of the de-energized tap-changer without insulating fluid. Ensure that the de-energized tap changer is fully immersed in insulating fluid.
4. Check that the drive functions correctly in accordance with the corresponding drive operating instructions and in accordance with the supplied documentation.
5. *NOTICE!* An incorrectly coupled drive will damage the de-energized tap-changer. Starting from the mid-position, undertake trial tap-change operations across the entire range of settings. Ensure that the tap position indicators of drive and de-energized tap-changer match in every operating position.
6. If necessary, repeat the transformer ratio test [▶Section 5.6, Page 29].

Dielectric tests on transformer wiring

› Note information relating to dielectric tests on transformer wiring in relevant operating instructions for motor-drive unit.

6.1.3 High-voltage tests on the transformer

Note the following points before performing high-voltage tests on the transformer:

- Ensure that the protective housing fastening is free of paint.
- When using a motor-drive unit, only perform the high voltage test if the motor-drive unit door is closed.
- Disconnect external connections to electronic components in the motor-drive unit to prevent damage from overvoltage.
- When connecting the motor-drive unit's supply voltage, only use the cable glands in the protective housing base intended for lead insertion.
- Guide all ground connecting leads to one central connection point (establishment of a suitable reference earth).

- Disconnect all electronic components before the high voltage test. Before a dielectric test of the wiring, remove all devices with a withstand voltage of < 1,000 V and disconnect the motor-drive unit from the power supply.
- Prior to performing the high voltage test, remove any cables not necessary for the high voltage test because otherwise they will act as antennas.
- Wherever possible, route the measurement leads and data leads separately to the energy cables.

Contact the manufacturer if you have any questions about possible sources of danger.

6.2 Transporting the transformer to the operating site

If the drive must be removed in order to transport the transformer, proceed as follows:

1. Ensure that the drive and the de-energized tap-changer are in the mid-position.
2. Remove the drive.
3. Do not actuate the drive while the de-energized tap-changer is not coupled and do not turn the output shaft.
4. Do not actuate a de-energized tap-changer which is not coupled and do not turn its drive shaft.
5. Transport the drive to the installation site in suitable packaging.
6. Fit the drive and the drive shaft to the transformer at the installation site.

6.3 Commissioning transformer at operating site

6.3.1 Function tests

Check the mechanical function of the drive and de-energized tap-changer before energizing the transformer.

1. ⚠ WARNING! An energized transformer could cause death or serious injuries! Ensure that the transformer is disconnected on the high-voltage and low-voltage sides.
2. Lock transformer to prevent unintentional start.
3. *NOTICE!* Damage to the de-energized tap-changer due to actuation of the de-energized tap-changer without insulating fluid. Ensure that the de-energized tap changer is fully immersed in insulating fluid.
4. Check that the drive functions correctly in accordance with the corresponding drive operating instructions and in accordance with the supplied documentation.
5. *NOTICE!* An incorrectly coupled drive will damage the de-energized tap-changer. Starting from the mid-position, undertake trial tap-change operations across the entire range of settings. Ensure that the tap position indicators of drive and de-energized tap-changer match in every operating position.
6. If necessary, repeat the transformer ratio test [▶Section 5.6, Page 29].

Dielectric tests on transformer wiring

› Note information relating to dielectric tests on transformer wiring in relevant operating instructions for motor-drive unit.

6.3.2 Commissioning the transformer

Proceed as follows to commission the transformer:

1. ⚠ DANGER! Ensure that the transformer is switched off on the high-voltage and low-voltage sides. Incorrect functioning poses a danger of death and damage to property when commissioning the transformer.
2. When using a motor-drive unit: Connect the drive to the tripping circuit of the circuit breaker on the transformer.

3. ⚠ DANGER! Ensure that the de-energized tap-changer and the drive are in the same operating position. Check the correct function of all safety measures. Incorrect functioning poses a danger of death and damage to property when commissioning the transformer.
4. Commission the transformer.

7 Operation

> If a de-energized tap-changer is to be operated in another position after more than 1 year of operation in one position, up to 5 switching operations per contact are required. We recommend checking the effectiveness of this action using a resistance measurement.

Carrying out tap-change operation

1. ⚠ DANGER! Switch off the transformer on the high and low-voltage side. Failure to do so may result in severe injuries and property damage.
2. Lock the transformer to prevent unintentional restart.
3. Ensure that everything is de-energized.
4. Visibly connect all transformer terminals to ground (grounding leads, grounding disconnectors) and short circuit them.
5. Cover adjacent, energized parts or put up barriers.
6. Carry out the tap-change operation.

8 Fault elimination

⚠ WARNING



Danger of explosion.

Explosive gases in the transformer can deflagrate or explode and result in death or severe injuries.

- Ensure that there are no ignition sources such as naked flames, hot surfaces or sparks (e.g. caused by the build-up of static charge) in the transformer's immediate surroundings and that none occur.
- De-energize all auxiliary circuits (such as the tap-change supervisory control) before removing the drive.
- Do not operate any electrical devices (e.g. risk of sparks from impact wrench).
- Only use conductive and grounded hoses, pipes and pump equipment that are approved for flammable liquids.

NOTICE

Damage to de-energized tap-changer and transformer!

Tripping of a protective device can indicate damage on the de-energized tap-changer and transformer! The transformer must not be energized without being inspected first!

- Check the de-energized tap-changer and transformer when a protective device has been tripped.
- Do not use the equipment again until you are sure there is no damage to the de-energized tap-changer and transformer.

The table below is intended to assist with detecting and, where possible, remedying faults.

In the event of faults on the de-energized tap-changer and motor-drive unit which cannot be easily corrected on site, or if a protective device has been tripped, please inform your authorized MR representative, the transformer manufacturer or contact us directly at:

Reinhausen GmbH
Technical Service
Postfach 12 03 60
93025 Regensburg
Germany
Phone: +49 94140 90-0
Fax: +49 9 41 40 90-7001
E-mail: service@reinhausen.com
Internet: www.reinhausen.com

Fault description	Measure
Activation of the tap-change supervisory device	Contact MR.
Activation of a motor protective device in the motor-drive unit	Follow the fault remedying table in the motor-drive unit operating instructions. If you are not able to remedy the problem, you can contact MR.
De-energized tap-changer not changing tap position (sluggishness, Raise keys/Lower keys not working)	Contact MR.
No change in voltage on the transformer despite change in position on the drive	Contact MR.
Tap position indicator on the drive and de-energized tap-changer are different	Contact MR.

Fault description	Measure
Noises at the drive shaft or the motor-drive unit when changing tap position	Ensure proper mounting of the drive shaft in accordance with these operating instructions and the motor-drive unit operating instructions. Check that hose clips and protective covers are seated correctly.
Warning or tripping of Buchholz relay on transformer	Notify transformer manufacturer.
Deviation from desired value when measuring winding resistance of the transformer	Contact the transformer manufacturer and, if necessary, MR, and provide measured values.
Deviation from desired value during dissolved gas analysis (transformer oil)	Contact the transformer manufacturer and, if necessary, MR, and provide measured values.
Deviation from desired value during transformer ratio test	Contact the transformer manufacturer and, if necessary, MR, and provide measured values.

Table 5: Fault elimination

9 Maintenance

⚠ DANGER



Electric shock!

An energized transformer could cause death or serious injuries.

- Switch off transformer on high and low-voltage side.
- Lock transformer to prevent unintentional restart.
- Ensure that everything is de-energized.
- Visibly connect all transformer terminals to ground (grounding leads, grounding disconnectors) and short circuit them.
- Cover or cordon off adjacent energized parts.

⚠ DANGER



Electric shock!

During work, any de-energized tap-changer components that are energized can lead to death or serious injuries.

- De-energize all auxiliary circuits, such as the tap-change supervisory device.
- Ensure that everything is de-energized.

⚠ WARNING



Danger of explosion!

Explosive gases in the transformer, pipe system, oil conservator and at the dehydrating breather opening can deflagrate or explode and result in severe injury or death!

- Ensure that there are no ignition sources such as naked flame, hot surfaces or sparks (e.g. caused by the build-up of static charge) in the transformer's immediate surroundings during commissioning and that none occur.
- Do not operate any electrical devices (e.g. risk of sparks from impact wrench).
- Only use conductive and grounded hoses, pipes, and pump equipment that are approved for flammable liquids.

9.1 Inspection

Monitoring the de-energized tap-changer and drive is limited to occasional visual inspections. For efficiency reasons, these visual inspections can be combined with the usual checks on the transformer.

Check the following:

Interval	Action
Annually	Check door seal, cable bushings, and ventilation of protective housing of drive.
Annually	Check correct function of the installed electrical heater in the protective housing of motor-drive unit.

Table 6: Inspection plan

9.2 Maintenance intervals

De-energized tap-changers installed in network transformers

De-energized tap-changers which are installed in network transformers and are operated only rarely do not require maintenance at regular intervals, because mechanical operation of the de-energized tap-changer does not involve any significant contact wear.

Recommissioning after maintenance

To recommission the transformer after maintenance, proceed as follows:

1. Ensure that the de-energized tap-changer and the drive are correctly centered.
2. ⚠ DANGER! Danger of death and damage to property. Ensure that the de-energized tap-changer and the drive are in the same operating position. Check the correct function of all safety measures.
3. Carry out a transformer ratio test and fill the transformer with oil.
4. Commission the transformer.

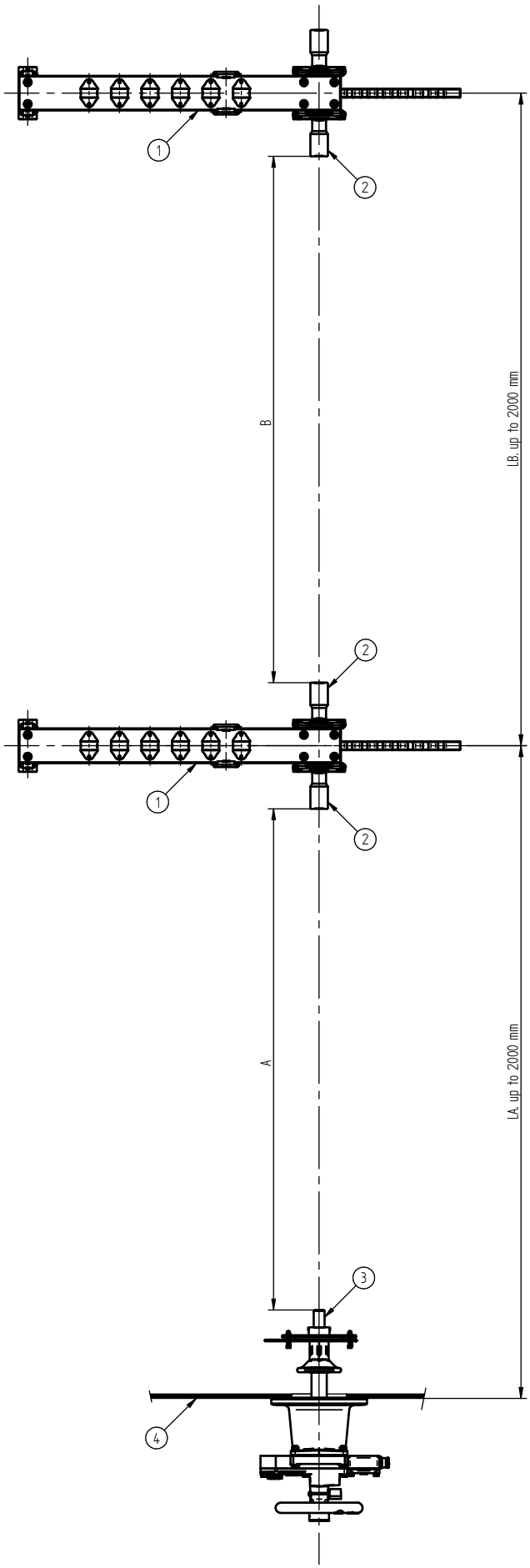
10 Technical data

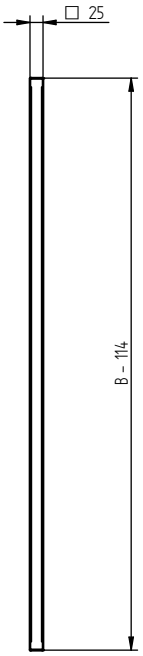
Number of stages	1-6
Max. rated through-current Ir [A]	1000/1600
Operating positions	2...15
Rated frequency [Hz]	50/60
Highest voltage for equipment Um [kV]	26/36/52/73
Drive	Manual drive (070-1.xxx)/electric drive (DETC CONTROL)
Temperature of the insulating fluid in operation	-25 °C...+105 °C
Transport temperature, storage temperature	-25 °C...40 °C
Drying temperature	Max. 120 °C
Insulating fluid	Mineral insulating oils as per IEC 60214, IEC 60296
Type test	In accordance with IEC 60214-1:2014 and IEEE C57.131-2024

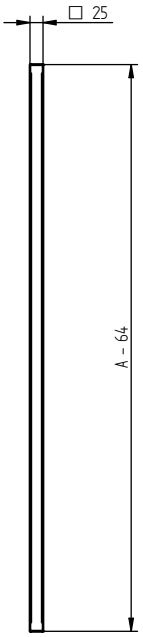
11 Drawings

11.1 Internal drive shafts

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1 – TAP CHANGER COLUMN
2 – SQUARE HOLE
3 – CONICAL COUPLING
4 – TRANSFORMER TANK WALL

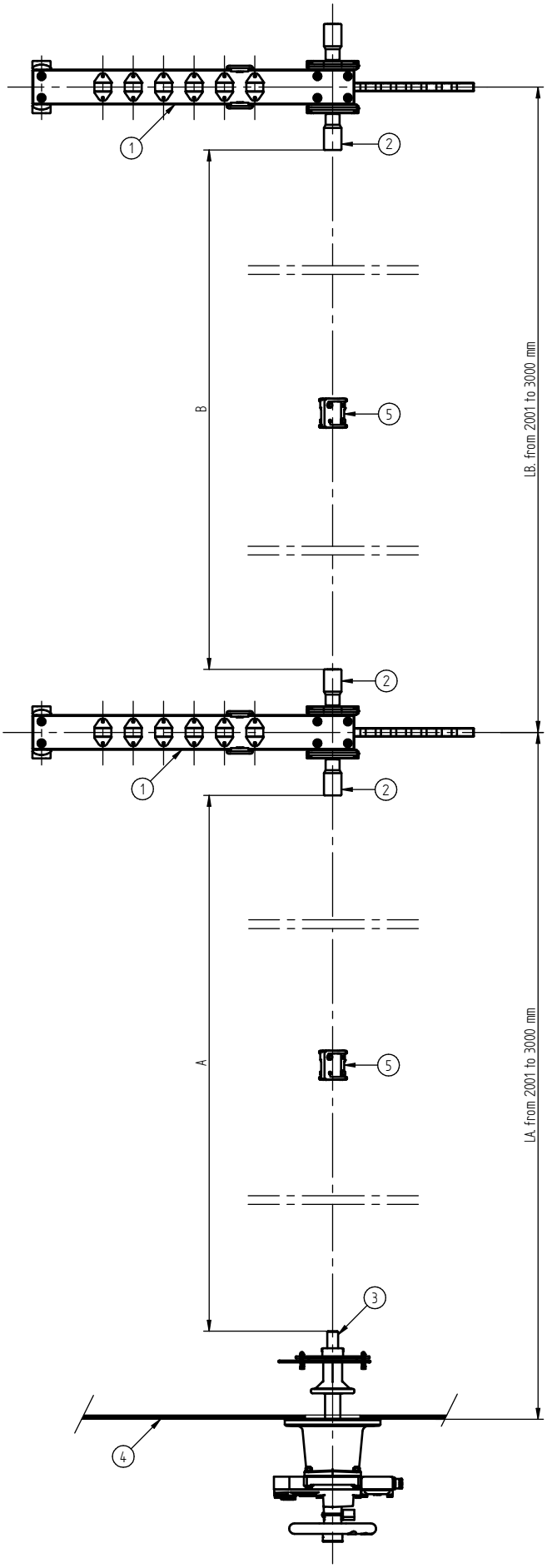
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Stand.	26.06.2026	CRESTANIN	1145073	1:10	

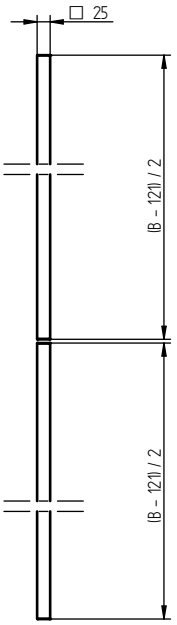
DIMENSION IN mm EXCEPT AS NOTED

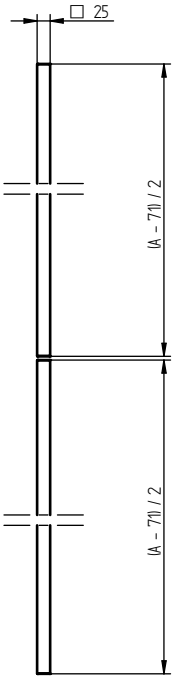
DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts without cardan joints

SERIAL NUMBER
–
MATERIAL NUMBER 101971990E
SHEET 1 / 1
A3

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1 – TAP-CHANGER COLUMN
2 – SQUARE HOLE
3 – CONICAL COUPLING
4 – TRANSFORMER TANK WALL
5 – EXTRA COUPLING BRACKETS

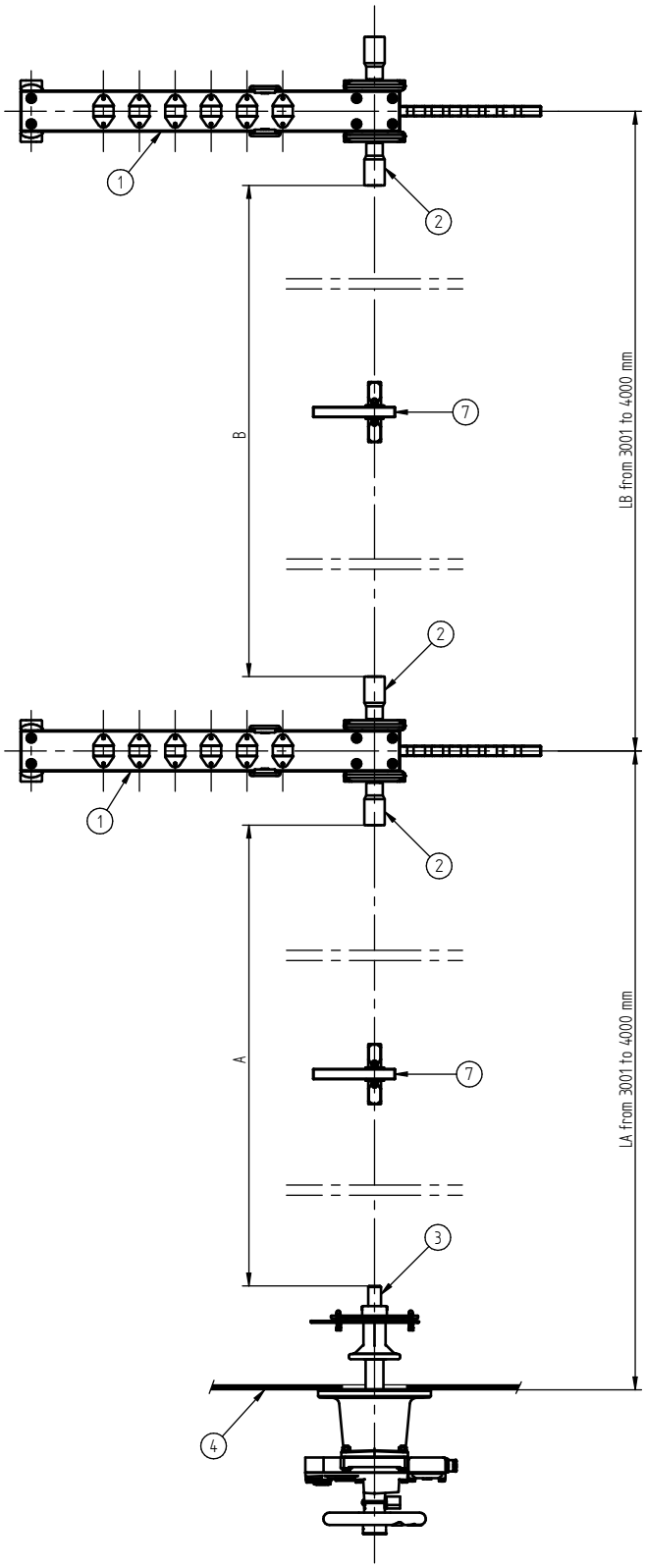
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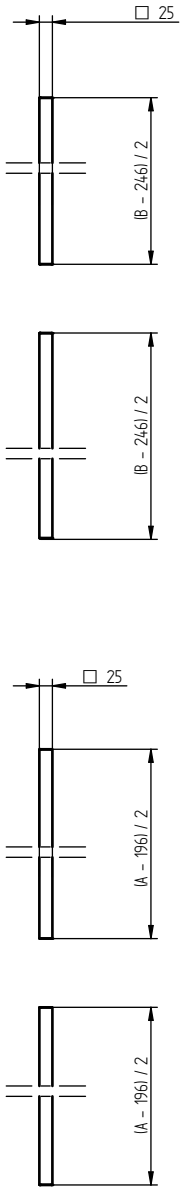
DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts without cardan joints

SERIAL NUMBER –
MATERIAL NUMBER 101972000E
SHEET 1 / 1
A3

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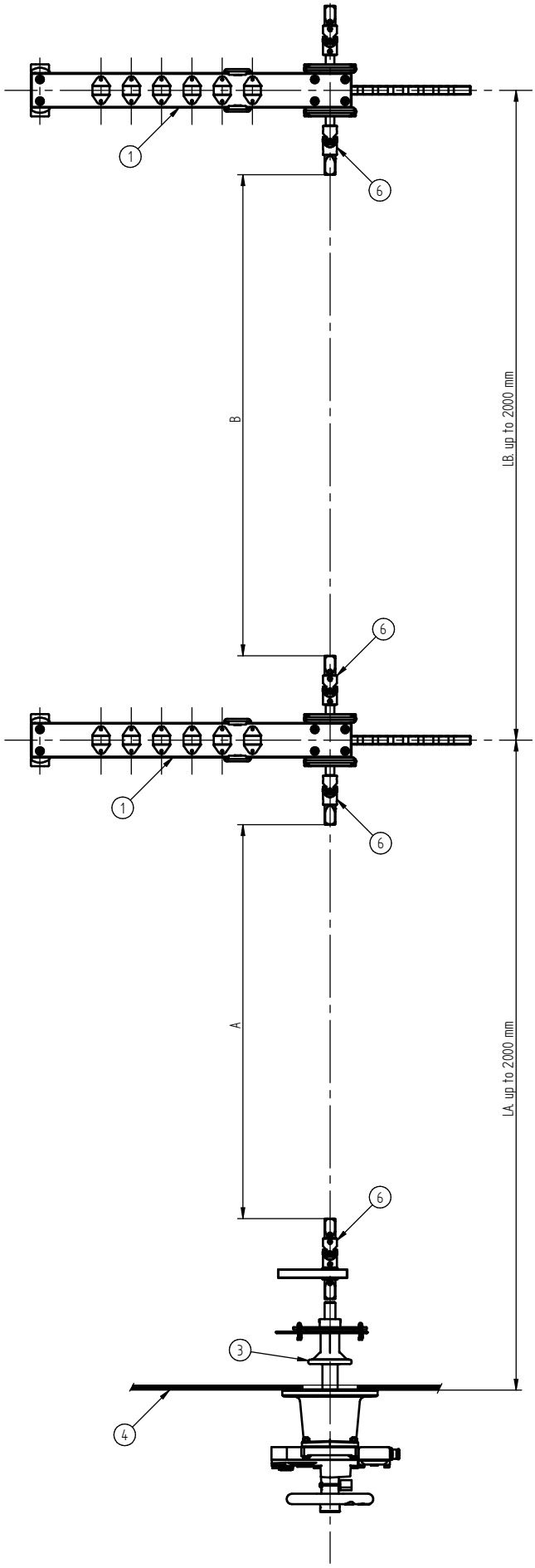
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2 – SQUARE HOLE
3 – CONICAL COUPLING
4 – TRANSFORMER TANK WALL
7 – INTERMEDIATE BEARING

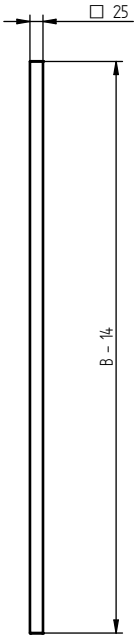
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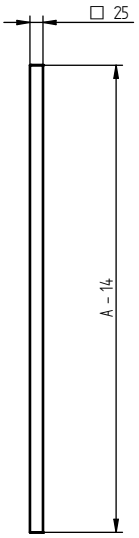
DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts without cardan joints

SERIAL NUMBER –
MATERIAL NUMBER 101972030E
SHEET 1 / 1
A3







1 – TAP-CHANGER COLUMN
3 – CONICAL COUPLING
4 – TRANSFORMER TANK WALL
6 – CARDAN JOINT

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DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts with cardan joints

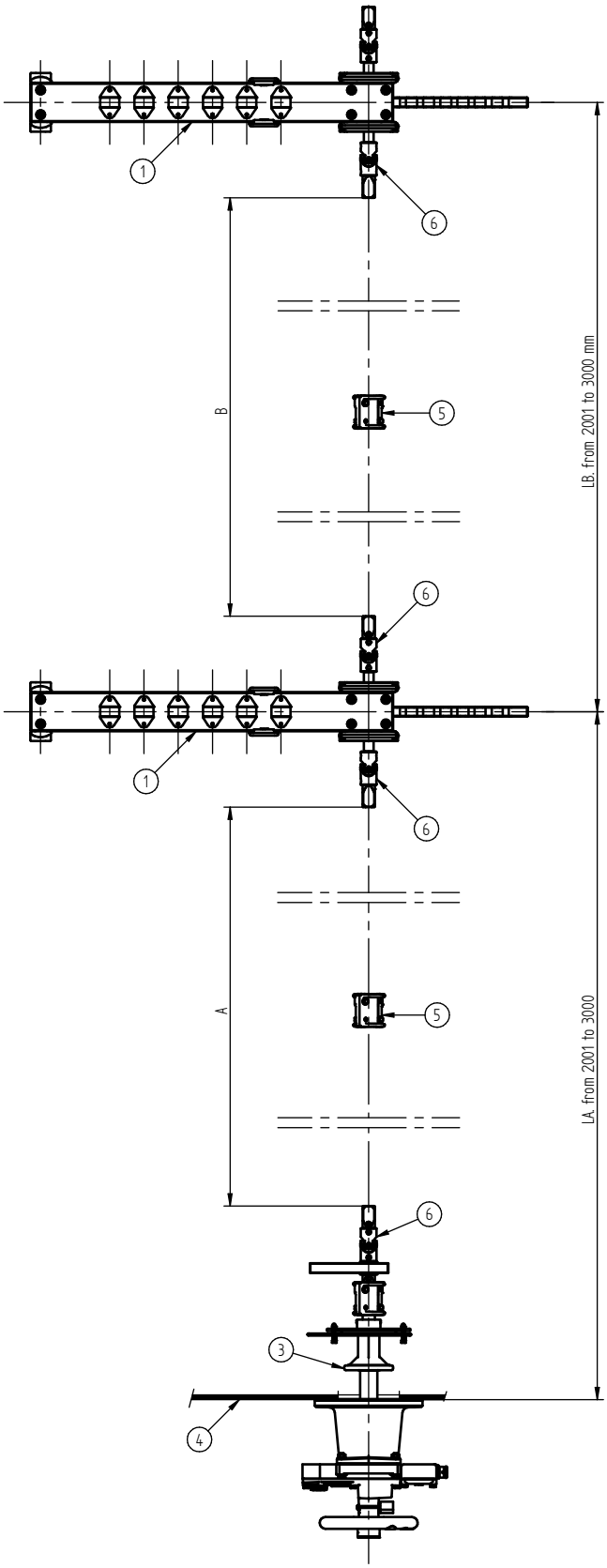
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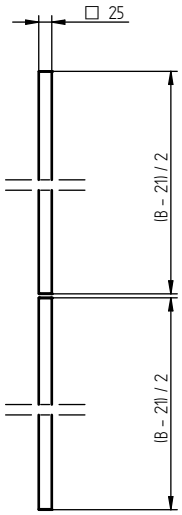
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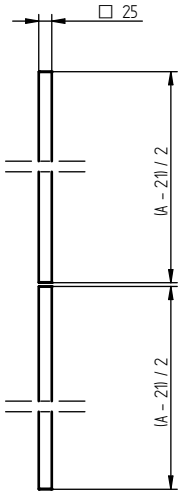
SHEET 1 / 1

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(1) – TAP-CHANGER COLUMN
(3) – CONICAL COUPLING
(4) – TRANSFORMER TANK WALL
(5) – EXTRA COUPLING BRACKETS
(6) – CARDAN JOINT

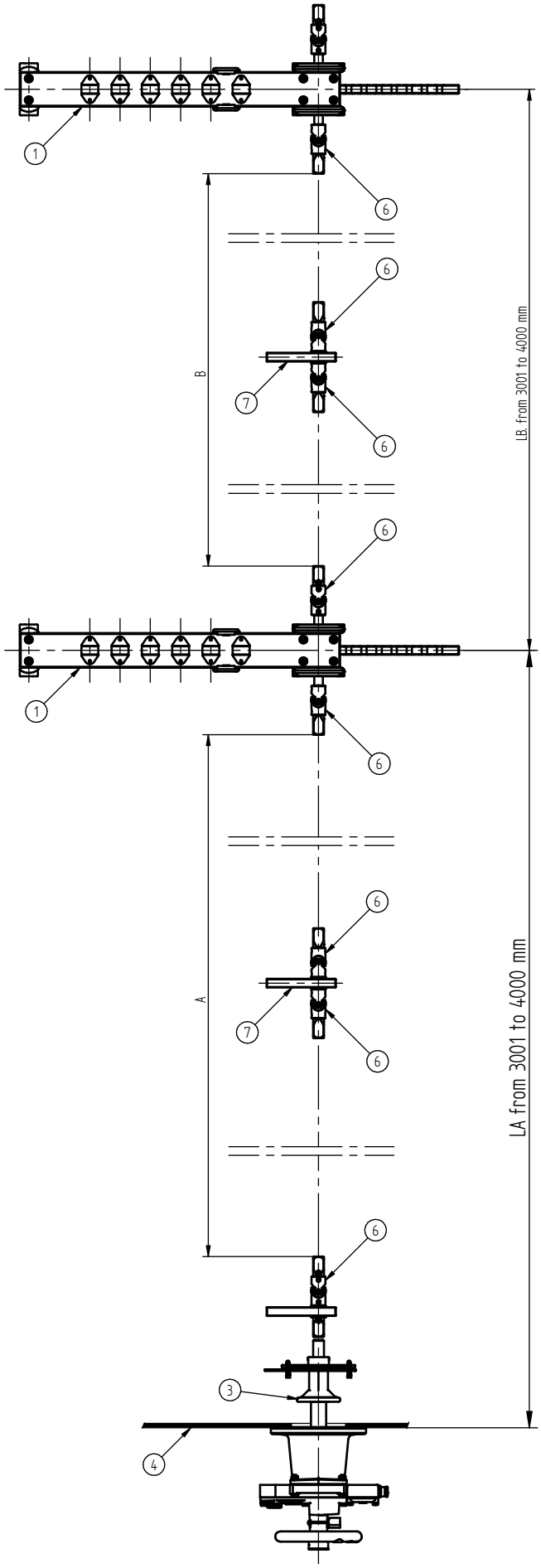
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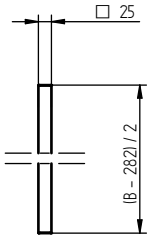
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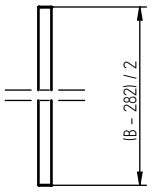
DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts with cardan joints

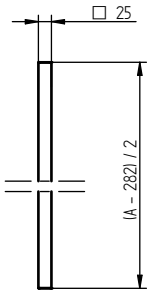
SERIAL NUMBER –
MATERIAL NUMBER 101972020E
SHEET 1 / 1
A3

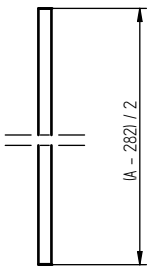
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1 – TAP-CHANGER COLUMN
3 – CONICAL COUPLING
4 – TRANSFORMER TANK WALL
6 – CARDAN JOINT
7 – INTERMEDIATE BEARING

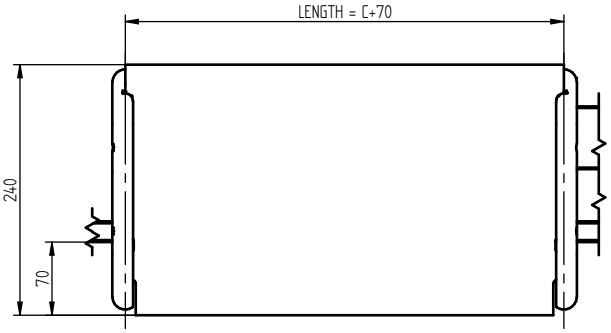
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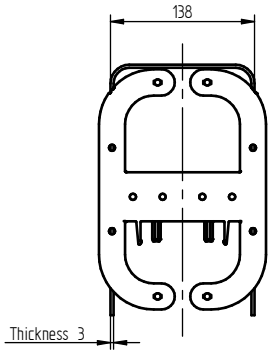
DIMENSION IN mm EXCEPT AS NOTED

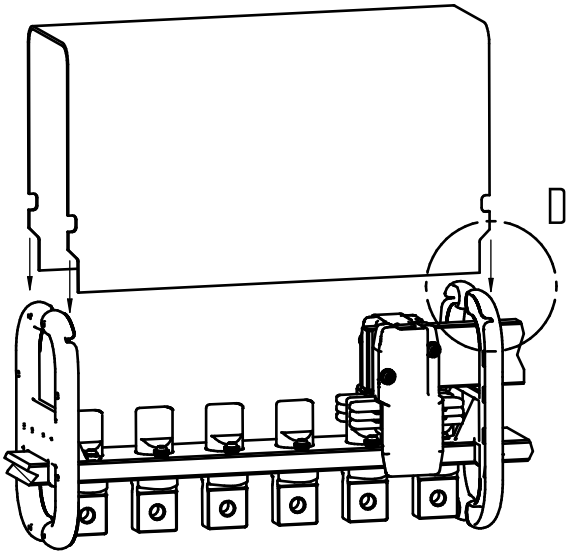
DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting square shafts with cardan joints

SERIAL NUMBER –
MATERIAL NUMBER 101972070E
SHEET 1 / 1
A3

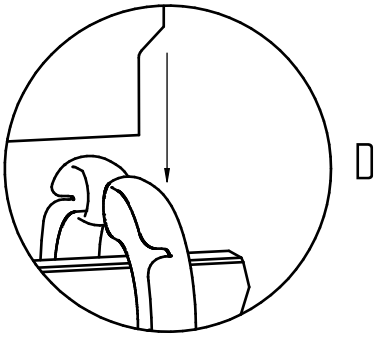
11.2 Protective shields



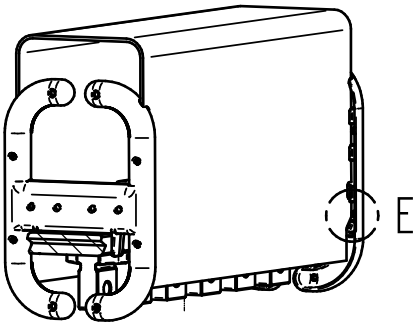


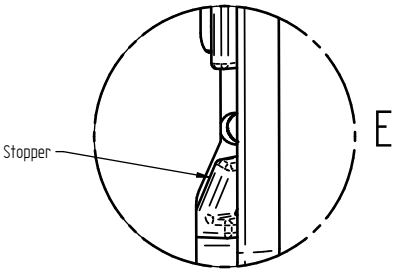


STEP 1 – Insert the spressboard shield, aligning the two flaps with the corresponding slots on the equipotential rings.

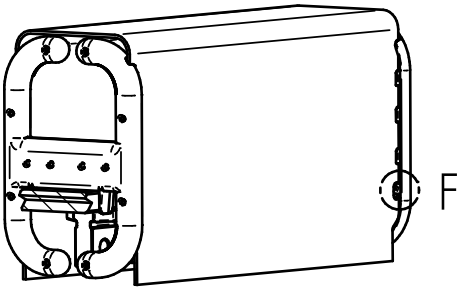


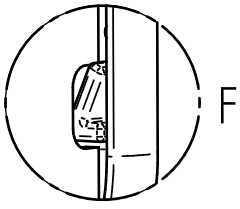
STEP 2 – Insert the spressboard shield until you feel increased resistance caused by these 4 stops.





STEP 3 – Press the shield more firmly; it will bend inwards, following the shape of the stoppers. At a certain point, the screen will click into place on the stoppers, fitting into the recess provided.





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Chkd.	23.06.2026	MONDINN	Change no.	Scale	
Stand.	24.06.2026	CRESTANIN	1145073	1:5	

DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Mounting pressboard shields

SERIAL NUMBER –

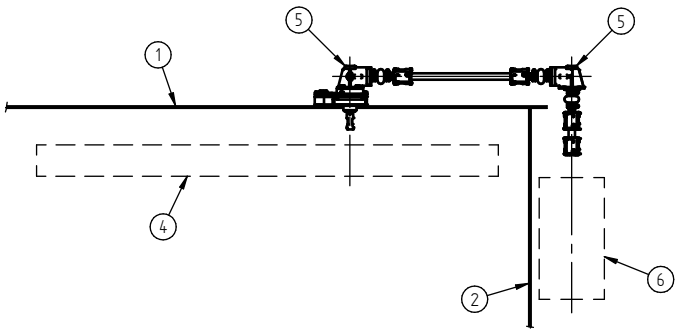
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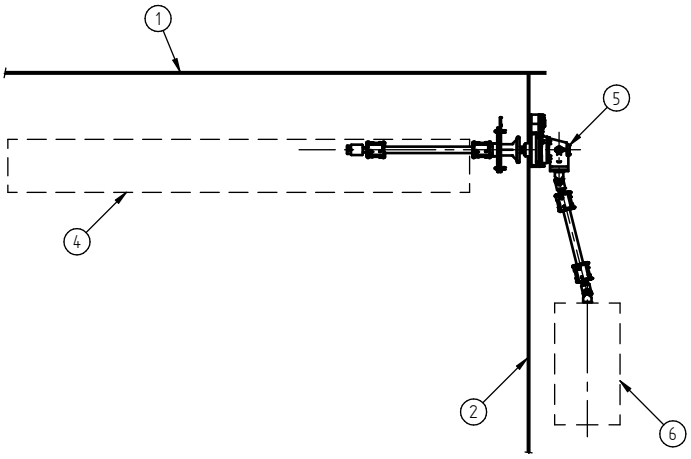
SHEET 1 / 1

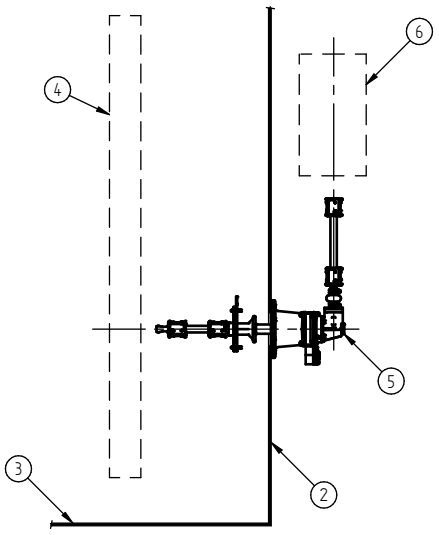
A3

11.3 Bevel gears and drive

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1 – TRANSFORMER TANK COVER
2 – TRANSFORMER TANK WALL
3 – TRANSKORMER TANK BOTTOM
4 – TAP-CHANGER
5 – BEVEL GEAR
6 – DRIVE

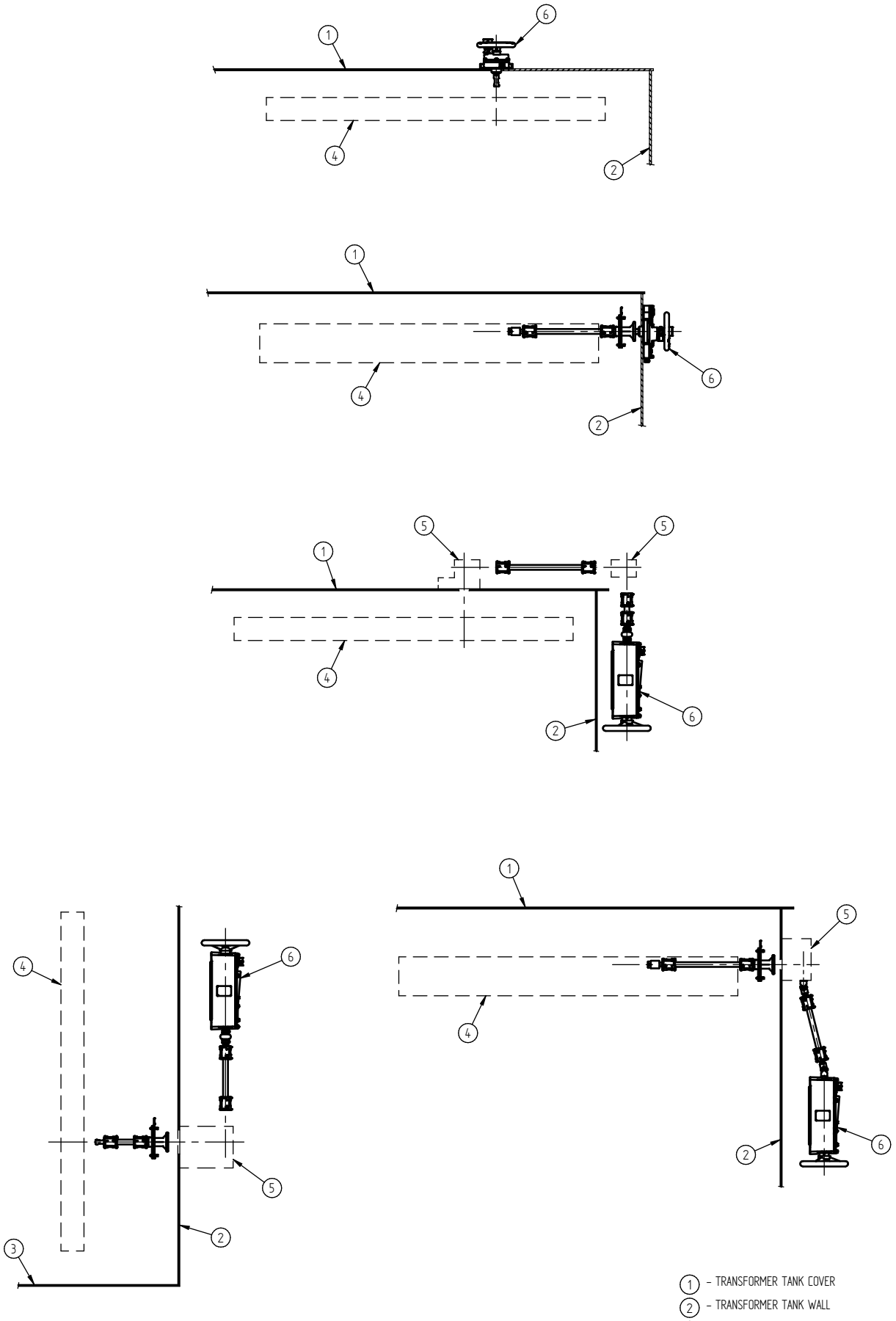
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Stand.	24.06.2026	CRESTANIN	1145073	1:20	

DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Fitting the bevel gears

SERIAL NUMBER –
MATERIAL NUMBER 101972180E
SHEET 1/ 1
A3

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1 – TRANSFORMER TANK COVER
2 – TRANSFORMER TANK WALL
3 – TRANSKORMER TANK BOTTOM
4 – TAP-CHANGER
5 – BEVEL GEAR
6 – DRIVE

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Stand.	24.06.2026	CRESTANIN	1145073	1:20	

DIMENSION IN mm EXCEPT AS NOTED

MR

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Fitting the drives

SERIAL NUMBER –

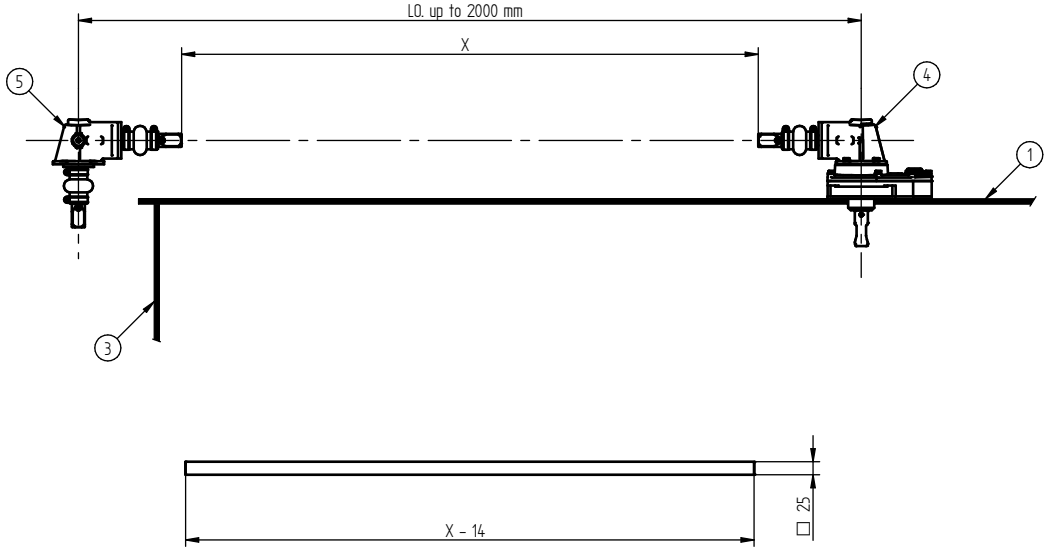
MATERIAL NUMBER 101972200E

SHEET 1 / 1

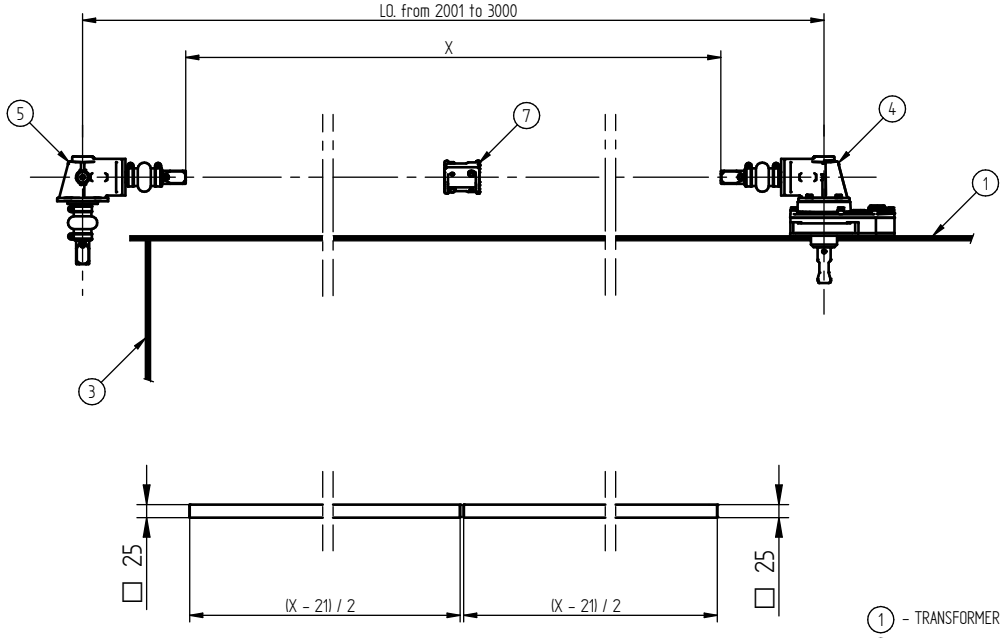
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11.4 External drive shafts

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1 - TRANSFORMER COVER
3 - TRANSFORMER TANK WALL
4 - BEVEL GEAR
5 - BEVEL GEAR



1 - TRANSFORMER COVER
3 - TRANSFORMER TANK WALL
4 - BEVEL GEAR
5 - BEVEL GEAR
7 - EXTRA COUPLING BRACKETS

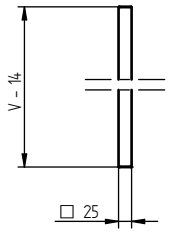
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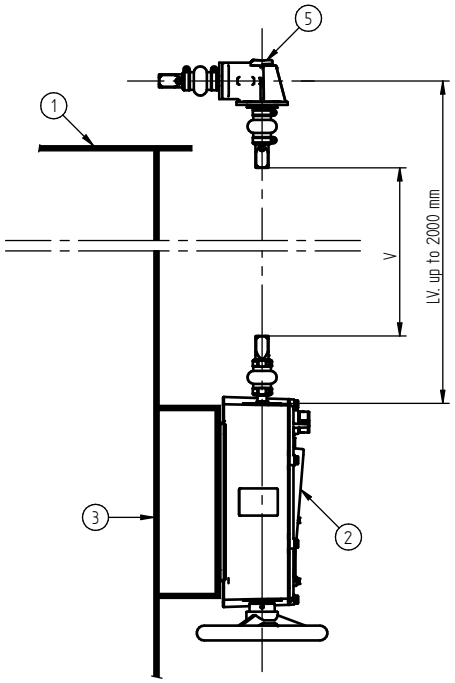
DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting external drive shafts between bevel gears

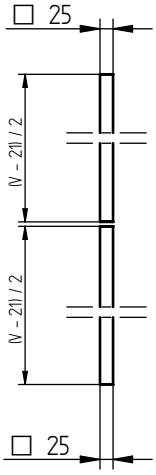
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MATERIAL NUMBER 101972100E
SHEET 1 / 1
A3

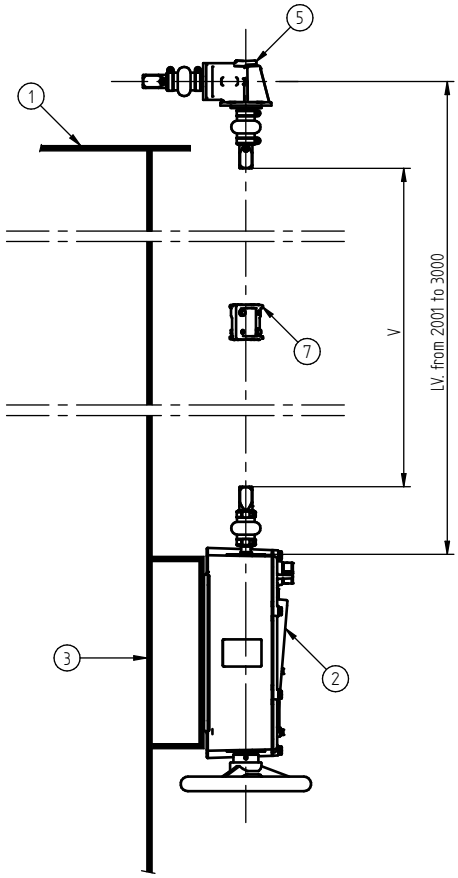
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1 – TRANSFORMER COVER
2 – DRIVE
3 – TRANSFORMER TANK WALL
5 – BEVEL GEAR





1 – TRANSFORMER COVER
2 – DRIVE
3 – TRANSFORMER TANK WALL
5 – BEVEL GEAR
7 – EXTRA COUPLING BRACKETS

	Date	Name	Document no.		Projection method
Dftr.	16.06.2026	CRESTANIN	SED 13107260 000 00		
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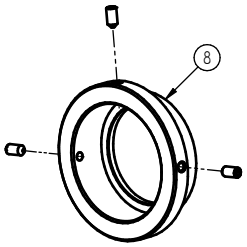
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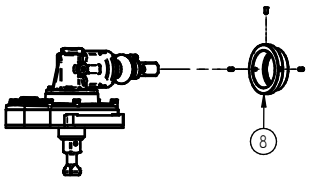
DE-ENERGIZED TAP-CHANGER CAPT® 040+
Cutting external drive shafts between bevel gear and drive

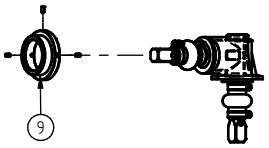
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SHEET 1 / 1
A3

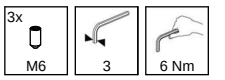
11.5 Telescopic protective tube

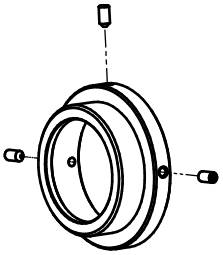
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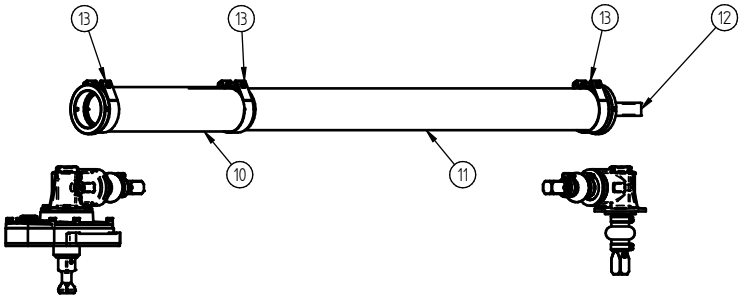


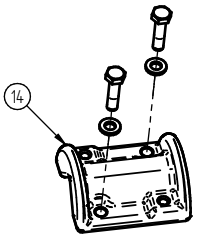


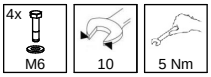


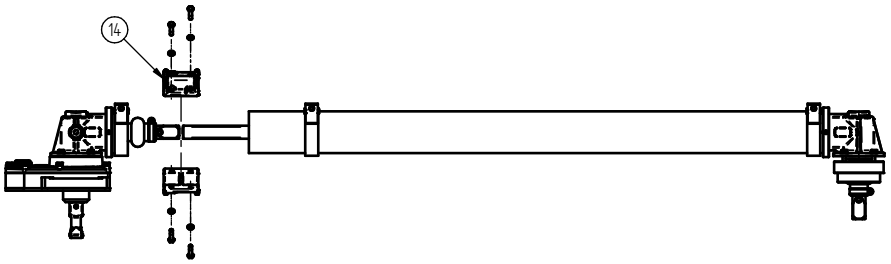


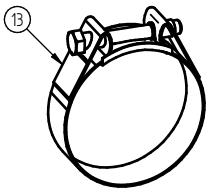


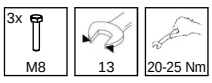


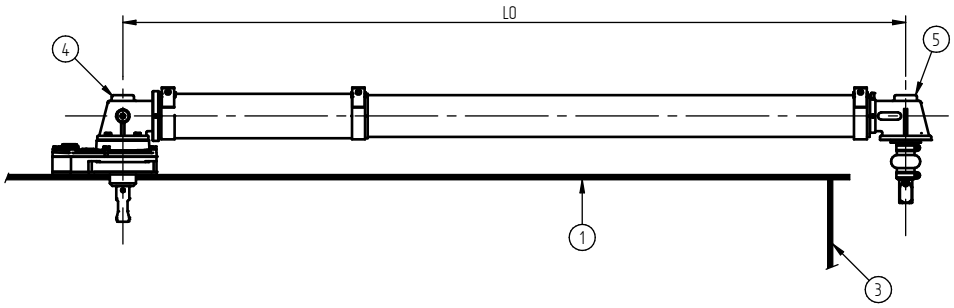












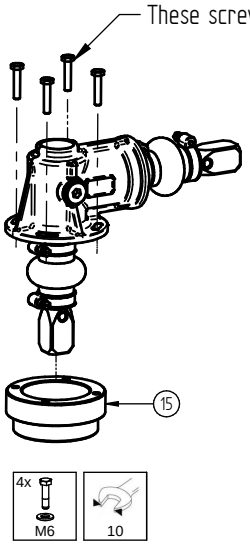
(1) – TRANFORMER COVER
(3) – TRANSKORMER TANK WALL
(4) – BEVEL GEAR
(5) – BEVEL GEAR
(8) – FLANGE FOR PROTECTIVE TUBE Φ85
(9) – FLANGE FOR PROTECTIVE TUBE Φ80
(10) – PROTECTIVE TUBE Φ85
(11) – PROTECTIVE TUBE Φ80
(12) – SQUARE SHAFT
(13) – HOSE CLIPS
(14) – COUPLING BRACKETS

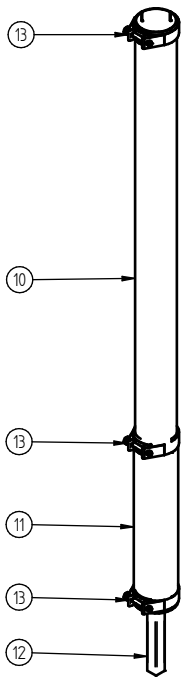
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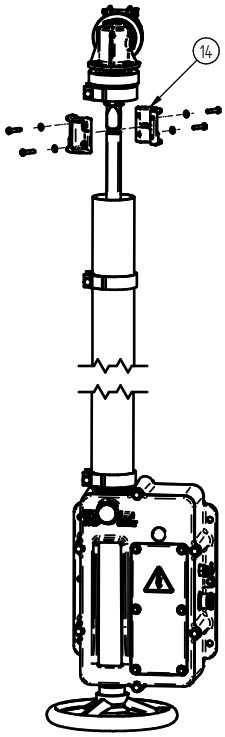
DIMENSION IN mm EXCEPT AS NOTED

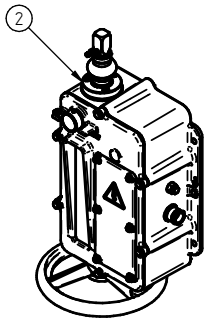
DE-ENERGIZED TAP-CHANGER CAPT® 040+
Mounting telescopic protective tube between bevel gears

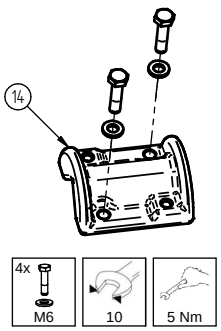
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A3

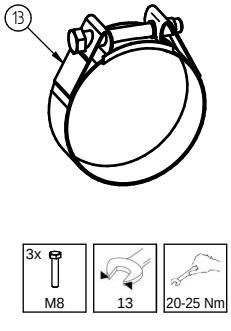


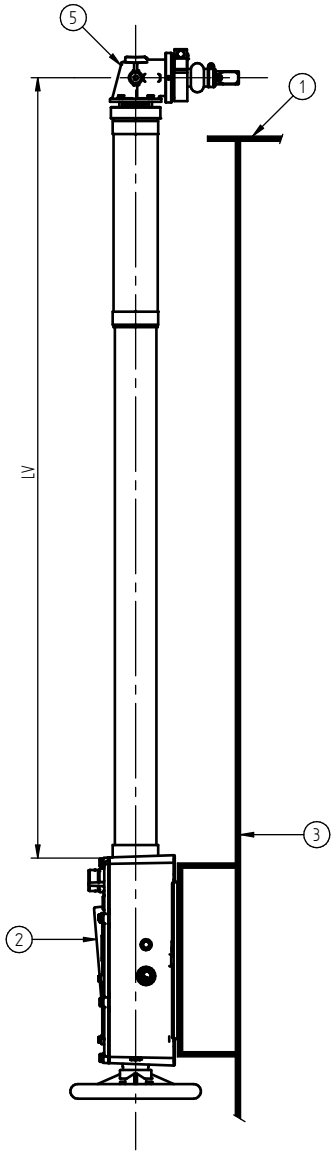












(1) – TRANSFORMER COVER
(2) – DRIVE
(3) – TRANSKORMER TANK WALL
(5) – BEVEL GEAR
(10) – PROTECTIVE TUBE Φ85
(11) – PROTECTIVE TUBE Φ80
(12) – SQUARE SHAFT
(13) – HOSE CLIPS
(14) – COUPLING BRACKETS
(15) – FLANGE FOR PROTECTIVE TUBE Φ85

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	Date	Name	Document no.		
Dftr.	16.06.2026	CRESTANIN	SED 13111668 000 00		
Chkd.	23.06.2026	MONDINN	Change no.	Scale	-
Stand.	24.06.2026	CRESTANIN	1145073		

Projection method

DIMENSION IN mm EXCEPT AS NOTED

DE-ENERGIZED TAP-CHANGER CAPT® 040+
Mounting telescopic protective tube between bevel gear and drive

SERIAL NUMBER –
MATERIAL NUMBER 101972170E
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THE POWER BEHIND POWER.